NATCO HANDBOOK

NATIONAL FIREPROOFING CORPORATION
GENERAL OFFICES PITTSBURGH

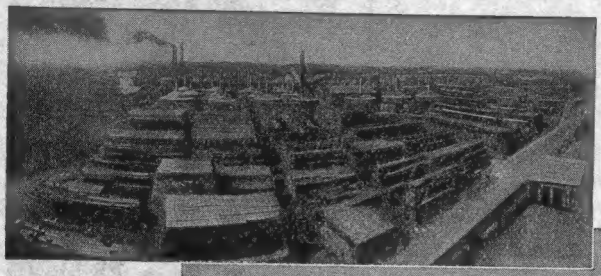
Fred Vanspielle

NATCO HANDBOOK

George Hawthorne.

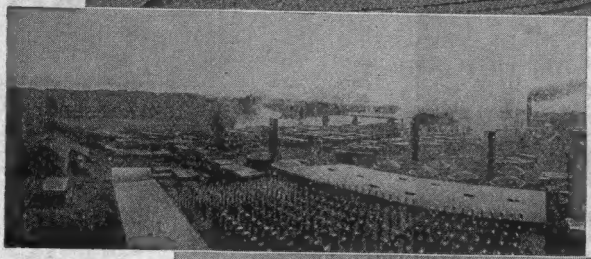
PRICE $2.00

A FEW NATCO PLANTS



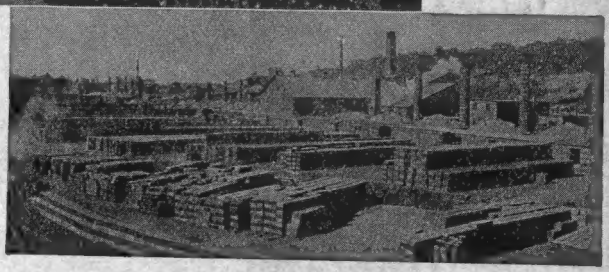
View of Natco plant
Raritan, New Jersey

Haydenville plant
located at Hayden-
ville, Ohio

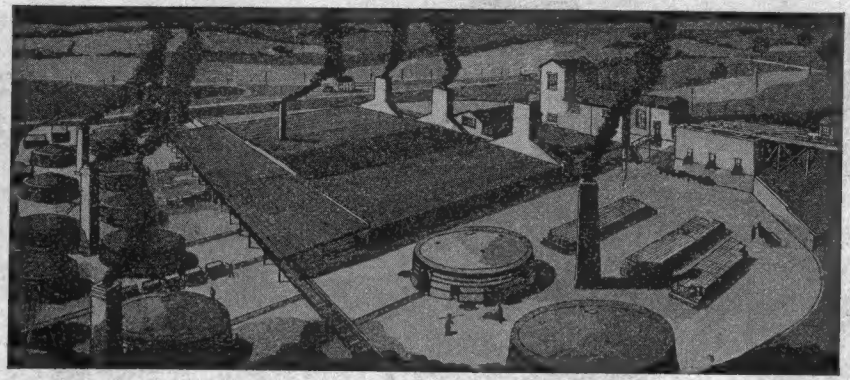


Showing plant at
Brazil, Indiana

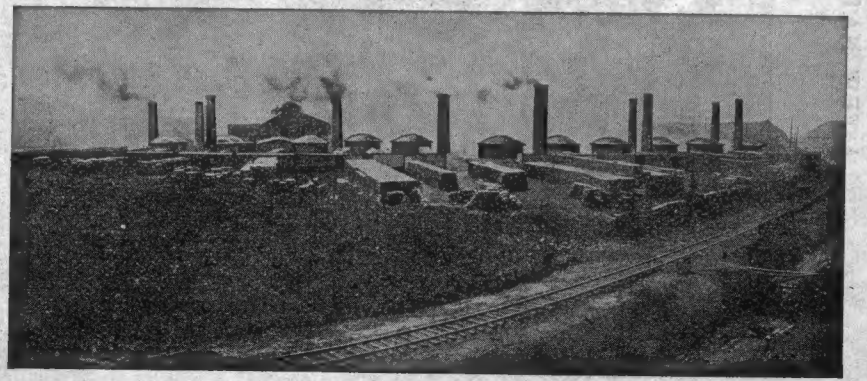
Natco plant located
at Ottawa, Illinois



Showing plant No. 1
and plant No. 2 at
Aultman, Ohio



Natco plant at East Palestine, Ohio



View of plant at East Canton, Ohio

NATCO HANDBOOK

This pocket size booklet is designed to provide, in compact, convenient form, essential data on the complete Natco line of Structural Clay Tile

WHATEVER THE TILE NEED, THERE IS A TYPE TO FILL IT IN THE COMPLETE NATCO LINE OF STRUCTURAL CLAY TILE

NATIONAL·FIREPROOFING·CORPORATION

General Offices: Fulton Building, Pittsburgh, Pa.

NEW YORK Chanin Building
CHICAGO Builders Building
PHILADELPHIA Land Title Building
BOSTON Textile Building

NATCO
THE *COMPLETE* LINE *of*
STRUCTURAL CLAY TILE

NATCO—the Complete Line of Structural Clay Tile, comprises units for exterior walls in steel and reinforced concrete skeleton buildings; units for interior partitions and all types of floors; units for covering beams, girders, and columns, protecting them against fire and corrosion; units for load bearing walls, faced with stucco, brick, or stone; units for finished face load bearing walls.

Made by a concern established for nearly forty years, backed by the production facilities of twenty-one plants in the United States and one in Canada; secured by undivided responsibility as to service, delivery, and quality, the Complete Natco Line of Structural Clay Tile gives for every requirement a tile that will give complete and lasting satisfaction.

Introduction

AFTER nearly forty years of use, Natco Structural Clay Tile is still the acknowledged standard by which efficiency in fireproof construction is reckoned. Many schemes have been tried out, and the tested and proved standards are few and simple. The steel or reinforced concrete skeleton, with brick or Structural Clay tile walls, floors of Structural Clay tile or Structural Clay tile and concrete, and subdividing walls and partitions of Structural Clay tile are recognized as best. Structural members must be covered and are best protected by Structural Clay tile.

We have not attempted in this manual to illustrate all the shapes of Natco Structural Clay Tile which are made or can be made. Only standard forms are shown and are carried in stock. Special shapes however, can be readily made to meet almost any requirements, for any type building.

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NATIONAL·FIREPROOFING·CORPORATION

General Offices, Fulton Building, Pittsburgh, Pa.

NEW YORK	CHICAGO	PHILADELPHIA	BOSTON
Chanin Building	Builders Building	Land Title Building	Textile Building

The Corporation:

Established in 1889, the National Fireproofing Corporation has been in business continuously since that time. It is the only concern in the world manufacturing a complete line of structural clay products.

Beside the branch sales and service offices, the corporation also operates as contractors for fireproof construction in structural clay tile in the Chicago district.

Facilities:

The total production of the National Fireproofing Corporation approximates a million tons of tile annually. This production comprises structural clay tile to meet every building need.

The corporation operates twenty-one plants in seventeen different localities, in close proximity to the principal tile markets of the country. In addition, it operates a plant in Hamilton, Ontario. It owns or leases over 5000 acres of clay deposits. It is estimated that the deposits thus controlled contain not less than 56,000,000 recoverable tons of clay, which, at the normal rate of operation, is sufficient to last more than fifty years.

Reliability:

The rating of the corporation in Dun and Bradstreet, together with its long record of fair dealing with its customers is the best possible guarantee of its dependability and stability.

Branding:

All structural clay tile manufactured by the National Fireproofing Corporation is branded with the trade mark name "Natco." Special types bear, in addition, marks of identification, such as Natco XXX, Natco Header Backer, Natco Unibacker, etc. All tile intended for load bearing walls is so branded.

The Product:

Natco Structural Clay Tile is made from special clay, found only in certain favored localities. This clay is mined and moulded into scientifically designed shapes that provide maximum strength and durability with a minimum of weight. These shapes are dried, then placed in large kilns where they are exposed to a temperature of over 2000 degrees varied to suit the structural or non-structural use of the ware.

The Complete Natco Line:

Natco, The Complete Line of Structural Clay Tile, comprises units to meet every building need in structures of every kind.

You have a single source of supply, backed by one united, uncompromising responsibility. Along with the tremendous production facilities of the company, you have the stability, the experience and the practical knowledge of the needs of the field that has come with over forty years in business.

Engineering Service:

The corporation maintains an adequate and efficient Engineering Department. This department is anxious to co-operate and show you how you can most economically and satisfactorily use Natco Structural Clay Tile to the best advantage in every type of construction.

ADVANTAGES OF NATCO STRUCTURAL CLAY TILE

Permanence:

Made of selected clay, cured and burned under the careful supervision of graduate ceramic engineers, Natco tile is permanent in form and structure. It is unaffected by heat, cold, dampness and chemicals—never warps or disintegrates.

Strength:

Natco Tile is scientifically designed for the purpose to which it is to be applied. The aim is to obtain maximum strength, with minimum weight.

Minimum Weight:

Natco Structural Clay Tile, while equal or superior to other materials in strength, insulating qualities, and fire safety, affords through its lightness considerable savings in dead load as well as in steel and foundation costs.

Insulating Qualities:

With Natco Structural Clay Tile, the enclosed dead air spaces provide positive insulation against rapid changes in temperature. In wall construction where any of the types of double shell tile are used, the double shell construction itself, with its wide non-continuous mortar joints, together with the moisture stops at each end acts as an additional barrier against the passage of cold, heat and moisture.

Due primarily to its insulating qualities, Natco Structural Clay Tile has no equal as a covering for steel. In floor construction, its insulating qualities give it a distinct advantage over other types of floors.

Fire Safety:

Made of raw material—clay—which is absolutely non-inflammable, and then exposed during manufacture to over 2000 degrees of heat, Natco Tile is obviously fire-resistive. Its rate of heat transfer is very low, so that it is the ideal material to shield steel work in skeleton buildings.

Soundproofness:

Due to the dead air spaces which resist the passage of sound, walls and floors of Natco Structural Clay Tile are more nearly soundproof than any solid structural materials.

Installations:

So many outstanding buildings all over the country have been constructed of Natco Structural Clay Tile, that it is out of the question to give even a partial list. In thousands of public buildings, skyscrapers, hospitals, schools, institutions of all kinds, residences, industrial and commercial buildings, and other types of structures, Natco Structural Clay Tile has been used and is giving perfect satisfaction.

Distribution:

Natco plants are strategically located near the principal tile markets of the country. Wherever possible, orders are placed with those plants most advantageously located in order to make savings in transportation charges.

Shipping:

Natco Tile are loaded by experts, under close supervision, assuring that the cars will come through with a minimum of breakage. On material such as Vitritile, cardboard wrappers are used, to assure arrival in first class condition.

Single Source of Supply:

Instead of buying wall tile one place, floor tile another, you can—by using Natco—fill all tile needs from a single source of supply. Shipments may be better arranged to suit your needs, car load lots may be made up instead of expensive partial shipments and all responsibility will rest with one concern.

TELEGRAPHIC CODE NAMES—NATCO PRODUCTS

Below are code names for different Natco products. The use of these code names eliminates the possibility of errors in specifying sizes, finishes, shapes, etc. of different types of Natco Structural Clay Tile.

Algonquin.....3¾x12x12 Bakups
Amazon.....6x12x12 6-cell Partition
Apache.....10x12x12 XXX
Arapaho.....12x12x10½ XXX Backers
Aztec.....12x12x10½ D. S. Backers

Bear.....8x5x12 Headers
Beaver.....8x12x5 D. S. M. S. Tex-Tile
Bison.....8x12x5 D. S. Glazed Tex-Tile
Blackfeet.....10x7¾x12 Unibacker—Scored

Canary.....3x12x12 Glazed Partition S2S
Cayuga.....8x12x5 D. S. Glazed Combed Face
Cherokee.....12x12x12 XXX
Cheyenne.....10x12x10½ XXX Backers
Chicasaw.....8x8x8 Cubes
Chippewa.....6x12x12 XXX
Choctaw.....8x6¼x12 Interlockers
Comanche.....6x12x10½ XXX Backers
Crane.....12x8x16 Building Block R. F.
Creek.....3¾x12x10½ XXX Backers
Crow.....10x8x16 Building Block R. F.

Dakota.....8x12x5 D. S. Unglazed Combed Face
Deer.....6x5x12 Headers

Eagle.....8x8x16 Building Block (2-cell)
Eskimo.....8x12x12 Partition (6-cell)

Fox.....10x5x12 Headers

Hawk.....4x8x16 Building Block R. F.
Huron.....8x7¾x12 Unibackers

Inca.....10x12x10½ D. S. Backers
Indian.....2x12x12 Split Furring
Iroquois.....12x12x12 Partition (4 cell)

Miami.....5x12x12 Partition (6 cell)
Mingo.....2x12x12 Partition (3 cell)
Mohawk.....8x12x12 Partition (4 cell)
Mohican.....10x12x12 Partition (4 cell)

Navajo.....3¾x12x12 XXX

TELEGRAPHIC CODE NAMES—Continued

Ojibwa	6x12x5 D. S. Unglazed Combed Face
Onondago	6x12x12 D. S. Load Bearing
Osago	8x5x12 Bakups
Oswego	10x12x12 D. S. Load Bearing
Ottawa	12x12x12 D. S. Load Bearing
Otter	3x12x up to 18 Book Tile
Owl	8x8x16 Building Block D. S.
Ozark	8x12x12 D. S. Load Bearing
Pawnee	8x12x12 XXX
Perch	4x5x12 Glazed Blocks—S2S
Peru	8x12x10½ D. S. Backers
Pigeon	8x12x12 Glazed Partition S2S
Pike	8x5x12 Glazed Blocks S2S
Pontiac	8x12x12 XX
Pueblo	12x12x12 XX
Robin	6x12x12 Glazed Partition S2S
Sawk	12x7¾x12 Unibackers
Seminole	3x12x12 Partition (3 cell)
Seneca	4x12x12 Partition (3 cell)
Shawnee	8x12x10½ XXX Backers
Sioux	6x12x12 Partition (3 cell)
Sparrow	4x12x12 Glazed Partition S2S
Waco	7x12x12 Partition (6 cell)
Winnebago	6x12x5 D. S. Glazed Combed Face
Wolf	12x5x12 Headers
Yucatan	6x12x10½ D. S. Backers

A. S. T. M. Specifications

AMERICAN SOCIETY FOR TESTING MATERIALS
1315 SPRUCE STREET, PHILADELPHIA, PA.

STANDARD DEFINITIONS OF TERMS RELATING TO HOLLOW TILE

Serial Designation: C 43–24

These definitions are issued under the fixed designation C 43; the final number indicates the year of original adoption as standard or, in the case of revision, the year of last revision.

ISSUED AS TENTATIVE, 1921; ADOPTED IN AMENDED FORM, 1924.

I. Tile:

1. **Hollow Tile:** Hollow building units with parallel cells.

NOTE—In the present state of the art the term "hollow tile," if used without a qualifying adjective, is understood to mean clay hollow tile.

The term "terra cotta," which is applied to ornamental building units of burned clay, should not be used to designate hollow tile.

2. **Load-Bearing Wall Tile:** Hollow tile for use as a load-bearing structural unit in walls.

(a) **Hollow Floor Tile:** Hollow tile for use as a load-bearing structural unit in floors.

(b) **Foundation Tile:** Hollow tile for use as a load-bearing structural unit in foundations.

(c) **Side-Construction Tile:** Hollow tile designed to receive its principal stress at right angles to the direction of its cells.

(d) **End-Construction Tile:** Hollow tile designed to receive its principal stress parallel to the direction of its cells.

(e) **Book Tile:** Hollow tile with tongue and groove edges resembling a book in shape.

(f) **Salt-Glazed Tile:** Clay hollow tile with a vitreous glaze on its surfaces produced by burning salt in the kiln at the temperature used in finishing the burning.

3. **Hollow Tile Fireproofing:** Hollow tile for use as a protection for structural members against fire.

(a) **Split Tile:** Hollow tile which has been knifed parallel with its cells in the process of manufacture for the purpose of separation into two equal units.

(b) **Partition Tile:** Hollow tile for use in building interior partitions, subdividing areas into rooms or enclosing stairways or shafts, and carrying no superimposed load.

(c) **Furring Tile:** Tile of suitable design for lining the inside of walls and carrying no superimposed load.

(d) **Porous Hollow Tile:** Clay hollow tile in which the natural porosity of the clay has been increased by the admixture of other ingredients.

II. Raw Materials:

4. **Shale:** A thinly stratified, consolidated sedimentary clay[1] with well-marked cleavage parallel to the bedding.

5. **Fire Clay:** A sedimentary clay[1] of low flux content.

NOTE—It is usually associated with coal measures.

6. **Surface Clay:** An unconsolidated, unstratified clay,[1] occurring on the surface.

[1]The definitions for the terms "surface clay," "fire clay," and "shale" are based upon the following definition for the term "clay:"

Clay—An earthy or stony mineral aggregate consisting essentially of hydrous silicates of alumina, plastic when sufficiently pulverized and wetted, rigid when dry and vitreous when burned at a sufficiently high temperature.

III. Designation of Dimensions:

7. Length: In the case of hollow tile, that dimension measured between its cut ends.

8. Thickness: In the case of hollow tile, that dimension designed to lie at right angles to the face of the wall, floor, or other member in which it is used.

9. Width: In the case of hollow tile, that dimension measured at right angles to the direction of its thickness and length.

NOTE—In practice, the first dimension given represents thickness; the second, width; the third, length.

IV. Parts, Openings and Surface Features:

10. Shell: In the case of hollow tile, the outer walls.

11. Webs: In the case of hollow tile, the partitions dividing it into cells.

12. Cells: In the case of hollow tile, the openings parallel with its shell and webs.

13. Scoring: In the case of hollow tile, the grooves formed in the exterior faces of the shell to increase the bond of mortar, plaster, or stucco.

STANDARD SPECIFICATIONS AND TESTS FOR HOLLOW BURNED-CLAY LOAD-BEARING WALL TILE[1]

A. S. T. M. Designation: C 34–27

These specifications are issued under the fixed designation C 34; the final number indicates the year of original adoption as standard or, in the case of revision, the year of last revision.

ISSUED AS TENTATIVE, 1921; ADOPTED IN AMENDED FORM, 1926; REVISED, 1927

Specifications:

1. Application: These specifications apply to hollow load-bearing wall tile made from surface clay, shale, fire clay or admixtures thereof.

Classification:

2. (a) Classification: According to the results of physical tests, tile shall be classified as Hard, Medium, and Soft on the basis of the following strength and absorption requirements, both of which must be met for a given class:[2]

Class	Absorption, Per Cent		Compressive Strength, Based on Gross Area, lb. per sq. in.*			
			End Construction		Side Construction	
	Mean of 5 Tests	Individual Maximum	Mean of 5 Tests	Individual Minimum	Mean of 5 Tests	Individual Minimum
Hard	12 or less	15	2000 or more	1400	1000 or more	700
Medium	16 or less	19	1400 or more	1000	700 or more	500
Soft	25 or less	28	1000 or more	700	500 or more	350

*Gross area shall be taken as the total area enclosed by the outside dimensions of the unit taken in a direction perpendicular to that in which the load is carried.

(b) Where end-construction tile are used on the side they shall meet the requirements of that construction, and vice versa.

[1] Under the standardization procedure of the Society, these specifications are under the jurisdiction of the A.S.T.M. Committee C-10 on Hollow Masonry Building Units.

[2] As different types of clay are used in the manufacture of tile, color cannot be taken as indicative of classification.

(c) All tile shall be so designed that substantially the same masonry strength will be developed in all wall thicknesses for which they are to be used.

Weights:

3. (a) **Weights:** The tile shall have the following dry weights determined as hereinafter specified:

Size of Unit, in.	Number of Cells	Standard Weight, Lb.
3¾ by 12 by 12	3	20
6 by 12 by 12	6	30
8 by 12 by 12	6	36
10 by 12 by 12	6	42
12 by 12 by 12	6	48
12 by 12 by 12	9	52
3¾ by 5 by 12	1	9
8 by 5 by 12	2	16
8 by 5 by 12	3	16
8 by 5 by 12 ("L" Shaped)	..	16
8 by 6¼ by 12 ("T" Shaped)	4	16
8 by 7¾ by 12 (Square)	6	24
8 by 10¼ by 12 ("H" Shaped)	7	32
8 by 8 by 8 (Cube)	9	18

(b) A tolerance of 5 per cent will be allowed on the above standard weights.

Dimensions:

4. **Dimensions:** No dimension shall vary more than 3 per cent from the standard dimensions for any form of tile.

Weathering Resistance:

5. **Weathering Resistance:** All tile used in exterior work subjected to weathering conditions shall be able to withstand 100 alternate freezings and thawings. Tile classed as hard or medium by these specifications may be considered as meeting the weathering requirement, provided they are burned to the normal maturity for the given clay. Tile classed as soft shall be accepted as meeting the weathering requirement only on the basis of freezing tests.

Fire Resistance:

6. **Fire Resistance:** The tile shall meet the following requirements as tested according to the Tentative Specifications for Fire Tests of Building Construction and Materials (A. S. T. M. Designation: C 19–26 T) of the American Society of Testing Materials[1] as they apply for bearing walls and partitions and to be acceptable shall develop the following resistance periods as tested unplastered:

Thickness of Wall, In.	Number of Units in Wall Thickness	Number of Cells in Wall	Resistance Period, Hours[a]
8	1	2	1½
8	1	3	2
12	1	3	3
12	2	3	4
12	2	4	5
16	2 or 3	4	6
16	2 or 3	6	8

[a] These are near the minimum values developed in tests. The average results will generally be higher. Plaster coatings ¾ in. thick applied on both sides and remaining in place throughout the fire test will increase the periods by 1 to 2 hours.

[1] Proceedings, Am. Soc. Testing Mats., Vol. 26, Part I, p. 761 (1926); also 1929 Book of A.S.T.M. Tentative Standards.

Workmanship and Finish:

7. **Workmanship:** All tile shall be well burned, reasonably free from laminations and from such cracks, blisters, surface roughness, and other defects as would interfere with the proper setting of the tile or impair the strength or permanence of the construction.

8. **Scoring:** The exterior surface of all tile intended for plaster or stucco shall be scored in such a manner as to give good adhesion.

Marking:

9. **Marking:** All tile shall bear the word "Load-Bearing" and initials, name or trademark of the manufacturer. These marks shall be indented on the exterior of the tile and shall be plainly legible.

Inspection and Rejection:

10. **Inspection:** Proper facilities shall be provided the purchaser for sampling and inspection either at the factory or at the site of the work, as may be specified in the contract. At least 10 days from the time of sampling shall be allowed for the completion of the test. The inspection shall be based on the requirements specified above. All tests shall be made in accordance with the methods hereinafter prescribed.

11. **Rejection:** Individual tile shall be rejected for failure to meet the weight, size or workmanship and finish requirements. In case of failure to meet the absorption and strength requirements for the class specified, the seller may sort the shipment and new samples shall be selected by the purchaser from the retained lot and tested at the expense of the seller. In case the second set of samples fails to meet the test requirements the entire lot shall be rejected.

12. **Expense of Tests:** Except as specified in Section 11 and unless otherwise agreed, the expense of inspection and testing shall be borne by the purchaser.

TESTS

Sampling:

13. **Selection of Samples for Test:** Samples of tile for testing shall be selected by the purchaser or by a competent representative authorized by him to do this work. In all cases the samples shall be representative of the whole lot of tile from which they are selected. Full-size tile shall be taken in all cases.

14. **Number of Samples:** For the strength, absorption, and weight determinations, five individual tile shall be selected from each kiln or from each 100-ton lot. In no case shall less than five tile be taken. For the fire test the size of the test panel will govern the number of tile required. Samples for the freezing tests shall be taken from tile that have not been subjected to strength or fire tests.

15. **Time and Place of Selecting Samples:** Samples for the strength and absorption tests shall be selected at the factory or at the site of the work, as specified. If the fire or freezing tests are to be made it shall be so specified at the time of placing the order, samples for fire tests being selected at the factory at least 45 days in advance of the time of filling the order and 90 days in advance for freezing tests.

16. **Marking Samples:** All tile selected for test shall be plainly and permanently marked for reference by the testing operator.

Weight Determinations:

17. **Weight Determinations:** The five tile, if not in kiln-dry condition, shall be dried to constant weight at a temperature of not less than 100° C. (212° F.) and be weighed separately. The scale shall be sensitive to within 0.5 per cent of the weight of the smallest unit.

Strength Tests:

18. **Samples:** Five full-size dry tile shall be used.

19. **Speed of Testing Machine:** The speed of the moving head of the testing machine shall not be more than 0.05 in. per minute.

20. **Bearing Block:** A sperical bearing block of proper design shall be placed on top of the test sample.

21. (a) **Capping:** Bearing surfaces of the test samples and portions adjoining them which are liable to absorb water from the plastic capping shall be coated with shellac and allowed to dry. A quantity of plastic mortar made of a mixture of three parts (by volume) of portland cement and one part of unretarded gypsum (plaster of Paris) mixed with sufficient water to spread evenly shall be placed on a plain surface which has been coated with oil, and allowed to harden sufficiently to bear the weight of the tile. The surface to be capped shall be placed on this mortar, and while holding the specimen so that its axis is at right angles to the capping surface it shall be given a single firm pressure.

(b) The average thickness of the cap after the extruded plaster has been removed and the edges trued shall not be more than ⅛ in. Patching of caps after setting shall not be permitted. Imperfect caps shall be removed and replaced with new ones.

(c) Where time is not available for aging the cement-gypsum cap, a cap of neat gypsum may be used, although the resulting tile strength will generally be lower than with the cement-gypsum cap. If the tile so capped fail to pass specification requirements on the score of strength, they shall be retested with portland-cement-gypsum caps aged not less than three days.

22. **Time of Testing:** When the cement-gypsum cap is used it shall age at least three days before the tile is tested. Where the neat gypsum cap is used the tile may be tested as soon as the plaster has been well set, but not sooner than one hour after the sample has been capped.

23. **Position of Tile:** All tile shall be tested in a position such that the load is applied in the same direction as in service.

Absorption Tests:

24. **Selection of Test Samples:** The samples shall consist of five tile or three representative pieces from each of these five tile. If small pieces are used, two shall be taken from the shell and one from an interior web, the weight of each piece to be not less than 227 g. (½ lb.). The samples shall have had their rough edges or loose particles ground off and be free from cracks from the failure of the tile in compression, where taken from tile which have been subjected to strength tests.

25. **Marking Test Samples:** Each piece shall be marked so that it may be identified at any time with the tile from which it was taken. Markings which do not cover more than 5 per cent of the total superficial area of the piece shall be used.

26. **Drying the Test Samples:** Preparatory to the absorption tests all samples shall be dried to constant weight in a drier or oven at a temperature of not less than 100° C. (212° F.).

27. **Accuracy of Weighings:** The balance used shall be sensitive to within 0.2 per cent of the weight of the smallest unit or piece tested.

28. **Saturation of Samples:** After obtaining the dry weight of the samples they shall be immersed in soft, distilled or rain water, raised to the boiling point and boiled continuously for one hour, and then allowed to cool in water to room temeprature.

29. **Obtaining Saturated Weights:** After saturation, the sample shall be removed from the water and allowed to drain for not more than one minute. The superficial water shall be removed with a damp cloth, after which they shall be weighed immediately.

30. **Calculating and Reporting Results:** The test results shall be calculated as percentages of the initial dry weight, carried to the nearest first decimal place. The results shall be reported separately for each tile, with the average for the five tile.

Freezing Tests:

31. **Sampling:** Where the freezing test is to be made, five separate representative tile shall be selected.

32. **Preparation of Samples:** If not possible to use the whole tile, a piece consisting of a cell not less than 4 in. long shall be sawed from the tile. These pieces shall be saturated by immersion in cold water for at least 72 hours prior to starting the freezing.

33. **Method:** Any practical method of obtaining alternate freezings and thawings may be used, the freezings to be always made with fully saturated samples and the time and temperature to be such as to insure full freezing and thawing throughout the specimen. The initial weighing and all weighings for loss shall be made on dry specimens.

34. **Accuracy of Weighings:** The balance used shall be sensitive to within 0.1 per cent of the weight of the smallest unit or piece tested.

35. **Interpretation of Results:** Failure under the freezing and thawing treatment shall be considered to be reached when:

(a) The samples show superficial disintegration or spalling with loss of weight of more than 5 per cent of the initial weight; or

(b) The samples are badly cracked; or

(c) The samples show evident loss of structural strength.

STANDARD SPECIFICATIONS AND TESTS FOR HOLLOW BURNED-CLAY FLOOR TILE[1]

Serial Designation: C 57–27

These specifications are issued under the fixed designation C 57; the final number indicates the year of original adoption as standard or, in the case of revision, the year of last revision.

ISSUED AS TENTATIVE, 1924; ADOPTED IN AMENDED FORM, 1927

Specifications:

1. **Application:** These specifications apply to hollow floor tile made from surface clay, shale, fire clay or admixtures thereof.

Classification:

2. (a) **Classification:** According to the results of physical tests, tile shall be classified as Hard, Medium, and Soft on the basis of the following strength and absorption requirements, both of which must be met for a given class:[2]

Class	Absorption, Per Cent		Compressive Strength Based on Net Area, lb. per sq. in.			
			End Construction		Side Construction	
	Mean of 5 Tests	Individual Maximum	Mean of 5 Tests	Individual Minimum	Mean of 5 Tests	Individual Minimum
Hard	12 or less	15	4800 or more	3000	2400 or more	1700
Medium	16 or less	19	3200 or more	2250	1600 or more	1100
Soft	25 or less	28	2000 or more	1400	1200 or more	850

[1] Under the standardization procedure of the Society, these specifications are under the jurisdiction of the A.S.T.M. Committee C-10 on Hollow Masonry Building Units.

[2] As different types of clay are used in the manufacture of tile, color cannot be taken as indicative of classification.

(b) Where end-construction tile are used on the side they shall meet the requirements of that construction, and vice versa.

Weights:

3. (a) **Weights:** The tile shall have the following dry weights determined as hereinafter specified:

FLAT ARCH

Depth of Arch, In.	Average Weight per Square Foot of Floor, Lb.
6	26
7	29
8	32
9	35
10	38
12	42
15	50

SEGMENTAL ARCH

Depth of Arch, In.	Average Weight per Square Foot of Floor, Lb.
6	30
8	36
10	40

TILE FOR USE IN COMBINATION HOLLOW TILE AND CONCRETE CONSTRUCTION

Size of Unit, In.	Minimum Number of Cells	Standard Weight, Lb.
4 by 12 by 12	3	16
6 by 12 by 12	3	22
6 by 12 by 12	4	25
8 by 12 by 12	4	30
10 by 12 by 12	4	35
12 by 12 by 12	4	40

(b) A tolerance of 5 per cent will be allowed on the above standard weights.

Dimensions:

4. **Dimensions:** No dimension shall vary more than 3 per cent from the standard dimensions for any form of tile.

Fire Resistance:

5. **Fire Resistance:** In cases where the fire resistance is an essential property the purchaser shall specify the degree of fire resistance (fire-resistance period) required, and the manufacturer shall supply such available information on the fire test performance of the given or closely similar product as will aid the purchaser in deciding whether the requirements are met. Further tests in accordance with the Tentative Specifications for Fire Tests of Building Construction and Materials (Serial Designation: C 19–26 T) of the American Society for Testing Materials[1] may be conducted by the purchaser.

Workmanship and Finish:

6. **Workmanship:** All tile shall be well burned, reasonably free from laminations and from such cracks, blisters, surface roughness and other defects as would interfere with the proper setting of the tile or impair the strength or permanence of the construction.

[1]Proceedings, Am. Soc. Testing Mats., Vol. 26, Part I, p. 761 (1926); also 1927 Book of A.S.T.M. Tentative Standards.

7. Scoring: The exterior surface of all tile intended for plaster shall be scored in such a manner as to give good adhesion.

Marking:

8. Marking: All tile shall bear the initials, name or trademark of the manufacturer. These marks shall be indented on the exterior of the tile and shall be plainly legible.

Inspection and Rejection:

9. Inspection: Proper facilities shall be provided the purchaser for sampling and inspection either at the factory or at the site of the work, as may be specified. At least 10 days from the time of sampling shall be allowed for the completion of the test. The inspection shall be based on the requirements specified above. All tests shall be made in accordance with the methods hereinafter prescribed.

10. (a) Rejection: Individual tile shall be rejected for failure to meet the weight, size, or workmanship and finish requirements. In case of failure to meet the absorption and strength requirements for the class specified, the seller may sort the shipment and new samples shall be selected by the purchaser from the retained lot and tested at the expense of the seller. In case the second set of samples fails to meet the test requirements the entire lot shall be rejected.

(b) **Acceptance:** By agreement, acceptance may be based on dry weight of the units, percentage absorption, fire resistance and the workmanship and finish.

11. Expense of Tests: Except as specified in Section 10 and unless otherwise agreed, the expense of inspection and testing shall be borne by the purchaser.

TESTS

Sampling:

12. Selection of Samples for Test: Samples of tile for testing shall be selected by the purchaser or by a competent representative authorized by him to do this work. In all cases the samples shall be representative of the whole lot of tile from which they are selected. Full-size tile shall be taken in all cases.

13. Number of Samples: For the strength, absorption, and weight determinations, five individual tile shall be selected from each kiln or from each 100-ton lot. Where tile of several designs are used, enough samples shall be weighed to determine the true average weight in pounds per square foot for the construction. In no case shall less than five tile be taken. For the fire test the size of the test panel will govern the number of tile required. Samples for the freezing tests shall be taken from tile that have not been subjected to strength or fire tests.

14. Time and Place of Selecting Samples: Samples for the strength and absorption tests shall be selected at the factory or at the site of the work, as specified in the contract. If the fire tests are to be made, it shall be so specified at the time of placing the order, samples being selected at the factory at least 45 days in advance of the time of filling the order.

15. Marking Samples: All tile selected for test shall be plainly and permanently marked for reference by the testing operator.

Weight Determinations:

16. Weight Determinations: The five tile, if not in kiln-dry condition, shall be dried to constant weight at a temperature of not less than 100° C. (212° F.) and be weighed separately. The scale shall be sensitive to within 0.5 per cent of the weight of the smallest unit.

Strength Tests:

17. Samples: Five full-size dry tile shall be used.

18. **Speed of Testing Machine:** The speed of the moving head of the testing machine shall not be more than 0.05 in. per minute.

19. **Bearing Block:** A spherical bearing block of proper design shall be placed on top of the test sample.

20. (a) **Capping:** Bearing surfaces of the test samples and portions adjoining them which are liable to absorb water from the plastic capping shall be coated with shellac and allowed to dry. A quantity of plastic mortar, made of a mixture of three parts (by volume) of portland cement and one part of unretarded gypsum (plaster of Paris) mixed with sufficient water to spread evenly shall be placed on a plain surface which has been coated with oil, and allowed to harden sufficiently to bear the weight of the tile. The surface to be capped shall be placed on this mortar, and while holding the specimen so that its axis is at right angles to the capping surface it shall be given a single firm pressure.

(b) The average thickness of the cap after the extruded plaster has been removed and the edges trued shall not be more than $\frac{1}{8}$ in. Patching of caps after setting shall not be permitted. Imperfect caps shall be removed and replaced with new ones.

(c) Where time is not available for aging the cement-gypsum cap, a cap of neat gypsum may be used, although the resulting tile strength will generally be lower than with the cement-gypsum cap. If the tile so capped fail to pass specification requirements on the score of strength, they shall be retested with portland-cement-gypsum caps aged not less than three days.

21. **Time of Testing:** When the cement-gypsum cap is used it shall age at least three days before the tile is tested. Where the neat gypsum cap is used the tile may be tested as soon as the plaster has been well set, but not sooner than one hour after the sample has been capped.

22. **Position of Tile:** All tile shall be tested in a position such that the load is applied in the same direction as in service.

Absorption Tests:

23. **Selection of Test Samples:** The samples shall consist of five tile or three representative pieces from each of these five tile. If small pieces are used two shall be taken from the shell and one from an interior web, the weight of each piece to be not less than 227 g. ($\frac{1}{2}$ lb.). The samples shall have had their rough edges or loose particles ground off and be free from cracks from the failure of the tile in compression, where taken from tile which have been subjected to strength tests.

24. **Marking Test Samples:** Each piece shall be marked so that it may be identified at any time with the tile from which it was taken. Markings which do not cover more than 5 per cent of the total superficial area of the piece shall be used.

25. **Drying the Test Samples:** Preparatory to the absorption tests all samples shall be dried to constant weight in a drier or oven at a temperature of not less than 100° C. (212° F.).

26. **Accuracy of Weighings:** The balance used shall be sensitive to within 0.2 per cent of the weight of the smallest unit or piece tested.

27. **Saturation of Samples:** After obtaining the dry weight of the samples they shall be immersed in soft, distilled or rain water, raised to the boiling point and boiled continuously for one hour, and then allowed to cool in water to room temperature.

28. **Obtaining Saturated Weights:** After saturation, the sample shall be removed from the water and allowed to drain for not more than one minute. The superficial water shall be removed with a damp cloth, after which they shall be weighed immediately.

29. **Calculating and Reporting Results:** The test results shall be calculated as percentages of the initial dry weight, carried to the nearest first decimal place. The results shall be reported separately for each tile, with the average for the five tile.

SIMPLIFIED PRACTICE RECOMMENDATION NO. 12

STRUCTURAL CLAY TILE

In accordance with the unanimous action of the joint conference of representatives of manufacturers, distributors, and users, the United States Department of Commerce, through the Bureau of Standards, recommends that the number of sizes of structural clay tile be reduced to the following:

TABLE 1

STANDARD LOAD-BEARING WALL TILE

	Number of Cells	Weight, Each
End construction:		Pounds
3¾ by 12 by 12	3	20
6 by 12 by 12	6	30
8 by 12 by 12	8	38
10 by 12 by 12	8	42
12 by 12 by 12	6	48
Side construction:		
3¾ by 5 by 12	1	9
8 by 5 by 12	2	16
8 by 5 by 12 ("L" shaped)		16
8 by 8¼ by 12 ("T" shaped)	4	16
8 by 7¾ by 12 (square)	8	24
8 by 10¾ by 12 ("H" shaped)	7	32

STANDARD PARTITION TILE

3 by 12 by 12	3	15
4 by 12 by 12	3	16
6 by 12 by 12	3	22
8 by 12 by 12	4	30
10 by 12 by 12	4	36
12 by 12 by 12	4	40

STANDARD SPLIT FURRING TILE

2 by 12 by 12		9

STANDARD BOOK TILE

		Pound per square foot
3 by 12 by 18 to 24		18

Not more than 5 per cent tolerance over or under allowable for weights and 3 per cent over or under for dimensions covering length, width, and height.

GEORGE K. BURGESS,
Director, Bureau of Standards.

APPROVED January 1, 1924, subject to regular annual revision by similar conference.

HERBERT HOOVER,
Secretary of Commerce.

General Specifications

GENERAL SPECIFICATIONS FOR ERECTING NATCO STRUCTURAL CLAY TILE

The data herein represent methods as approved by engineers and architects which were determined by wide practical experience in Natco Structural Clay Tile construction. Local building codes vary, and should of course always be taken into consideration in writing specifications.

SPECIFICATIONS FOR THE INSTALLATION OF NATCO STRUCTURAL CLAY TILE.

Local building codes vary and specifications should be written to agree.

General:

The contractor for this work will be required to furnish all the material and labor of every description required to erect the same in place complete. The contractor is referred to the plans for the general construction and details showing connection between the tile work and other trades.

Details:

When requested to do so, the contractor shall furnish large scale details of full-size drawings for all special shapes, column coverings, lintel covers, girder covers, and general type of arch; which shall be submitted to the architects for their approval.

Special Shapes:

The contractor shall furnish all necessary special shapes for the proper fitting to the steel work.

Scaffolding Tools, Etc.:

Furnish all tools, machinery, hoisting apparatus and centering necessary to carry on the work at the rate of progress stipulated in the contract.

Tile:

All the tile required for this work shall be of the best quality of uniformly hard-burned Structural Clay tile. This tile to be well manufactured. No badly split, cracked, or warped tile will be permitted to go into the work. Material to be NATCO Structural Clay Tile manufactured by the National Fireproofing Corporation.

Mortar and Laying:

All bearing walls shall be laid in mortar composed of 1 part of portland cement and 1/6 part of hydrated lime or lime putty to 3 parts of sand; floor arches shall be laid in mortar composed of 1 part of portland cement, ⅓ part of hydrated lime, or lime putty, to 4 parts of sand; partitions and fireproofing shall be laid in mortar composed of 1 part of portland cement, 1¼ part of hydrated lime and 6 parts of sand; all parts to be measured by volume. Lime putty shall be made from freshly burned lime thoroughly slaked. Mortar having taken its initial set shall not be used; retempering will not be permitted. Fill all joints between tile and steel with mortar.

SPECIFICATION FOR DESIGN AND CONSTRUCTION OF NATCO WALLS

General:

Provide and erect all Structural Clay tile exterior and interior bearing walls of tile manufactured of such design and laid in such position as will develop the full strength of the tile when laid in the wall. All tile shall be well burned, reasonably free from lamination and from such cracks, surface roughness and other defects as would interfere with the proper setting of tile or impair the strength or permanence of the construction. The exterior surface of all tile intended for stucco shall have dovetail scoring to give good adhesion.

In general, all exterior walls and interior bearing walls shall be of (Natco XXX Tile) (Natco Double Shell Load Bearing Tile) (Natco Tex-Tile) (Natco Glazed Comb Face Tile) (Natco Unglazed Comb Face Tile) (Natco

Header-Backer Tile) (Natco Unibacker Tile) (Natco Interlocker) (Natco Vitritile) (Natco Building Blocks) (Natco Cubes). All subdividing, non-bearing walls shall be of (Natco Partition Tile) (Natco Vitritile) of thickness shown on plans and as manufactured by the National Fire Proofing Corporation.

Laying:

In laying tile in exterior walls, they shall be laid in such a manner as to develop their full strength and no vertical or bed joints shall be mortared through the wall, but a generous air space shall be left in the center of the wall by buttering the two edges of each tile. This is to prevent the penetration of moisture by capillary attraction to the interior through the mortar joints. This precaution is unnecessary in interior walls. Sub-dividing, non-bearing partitions may be laid with the cells either vertical or horizontal. Care must be taken that the tops of all unfinished walls are covered or protected against stormy weather.

Foundation Walls:

Where so indicated on plans, the foundation walls from top of footings to the underside of first floor joists shall be constructed of Natco XXX, Natco Double Shell Wall Tile, Natco Glazed Building Block or Natco Vitritile. Care should be taken to use proper tile to make a bond at the corners. Tile shall be extra hard burned or salt glazed. If unglazed tile be used the outside of walls from footing to a point above the ground shall be given a heavy coat of waterproofed cement or other approved damp-proofing.

Where piers support heavy loads, they shall be filled with concrete to prevent the possibility of failure due to compression.

Exterior Walls and Bearing Partitions:

Exterior walls and bearing partitions shall be of thickness shown on the plans and must be in accordance with the foregoing conditions of quality, etc.

Subdividing Partitions:

Subdividing, non-bearing partitions shall be of NATCO Structural Clay Tile (scored for plastering). All partitions must be started on the structural floor and wedged against the floor above.

Jamb Tile:

Provide for all double hung windows, NATCO Jamb Tile with rabbetted openings to receive the window frame box. Fill well with mortar the space between the tile and the frame box to within one inch of stop bead and calk with roofers' cement or oakum to prevent the passage of air or moisture.

Lintels:

Openings not exceeding 5′ 0″ in clear span may be spanned with NATCO Load Bearing tile reinforced with rods in lower cells and filled solidly with concrete.

Openings over 5′ 0″ in clear span to be spanned with reinforced tile, concrete beams faced with tile, or with steel angles. Provide sufficient bearing on each side of opening.

Sills:

Form all sills of Natco special sill tile. Special care must be taken to fill all joints so as to prevent moisture working through the same; wood sill of frame to be set in a heavy bed of roofers' cement.

Arch Openings:

Build all arch openings shown on plans of structural clay tile units small enough to get proper camber without top mortar joints being too heavy. Arches will spring from the hollow tile and must be well bedded on them, and the width of the abutment must be sufficient to resist the thrust of the arch.

Porch Columns and Piers:

Construct the porch columns and piers of structural clay tile to sizes as shown. Where column finish is round, build the same of three-inch circular hollow tile column covering, filling the column with concrete whenever deemed necessary. Square columns shall be built of the proper size (NATCO XXX Tile), (Natco Textile). If steel reinforcement is used, care should be taken to band the steel against lateral deflection.

Floor Joist Bearings:

All joists must have a bearing of 4" on the wall and rest on bearing plates of 1" tile slabs, or the top course of tile under the joists may be filled with concrete to give a solid bearing. Tile slabs shall also be used to level up to story heights when the full or fractional tile do not work out correctly.

Joist Courses:

Where floor joists are framed into exterior walls, (Natco XXX Tile) (Natco Double Shell Load Bearing Tile) shall be used for facing the ends of the joists and for filling between them as follows: For facing 8-in. wall, 3¾x12x12-in; 10-in. wall, 6x12x12-in; 12-in. wall, 8x12x12-in; for filling between joist ends, use 3¾x12x10½-in. XXX Tile resting upon the 1-in. bearing slabs.

Roof Plates:

Embed in cement grout in two upper courses of wall at intervals of five feet, ¾ in. bolts 24 in. long. Bolts to project sufficiently above the top of the wall to allow of plate being fastened down with nuts.

Change:

Whenever a change in the thickness of a wall occurs, the loads on bearing shells and webs, which do not come into proper bearing, shall be distributed by means of tile slabs or brick, or the supporting course of tile shall be filled solidly with concrete.

Concentrated Loads:

Whenever heavy beams or girders, etc. are seated upon hollow tile walls or where other concentrated loads occur, the loads shall be so distributed by means of bearing plates of steel, or by brick, concrete or other solid masonry that the unit stress shall not exceed the allowable working stress herein given. Where pilasters occur under concentrated loads, the cells of the tile shall be filled solidly with 1-2-3 stone or gravel concrete where the loads exceed the safe load on the unfilled tile.

Specifications for Stucco on Structural Clay Tile:

All joints, between door frames, window frames at head, sides and sills, must be tightly calked with oakum or roofers' cement; also the wash or slope of sills, etc. must be given a heavy coat of waterproofing before stucco is applied.

All stucco should be applied immediately upon being mixed and must not be retempered after it has become partially set. No stucco is to be applied in freezing weather or when it is liable to freeze before it sets. Keep all stucco work thoroughly wetted down until cement has set, particularly in hot weather as too rapid drying will cause cracking.

The surface to which scratch coat is applied shall be free from all foreign matter, and shall be thoroughly wetted down before the first coat is applied. The first coat to be applied with force so as to key behind the dovetail scoring, also to prevent air bubbles or holes, and to be thoroughly scratched to insure proper bond with the next coat. The second coat should be applied as soon as the prior coat has sufficiently set to allow working upon the same, and should be straightened with darby and straight edge, then floated with cork, or wooden float to prevent waves showing on the finished wall.

Should it be impossible to apply the second and later coats as soon as the preceding coat has become thoroughly set, then wet down the coat which has been applied before applying another coat.

The finish coat should, as far as possible, be applied to the entire area of one side of structure at one operation. No finish coat should be left in an unfinished condition. All work should be covered to corners.

Thickness of each coat should average from one-quarter to one-half an inch. While two coats of stucco, carefully applied, having a total thickness of not less than three-quarters of an inch is allowable for rough cast or pebble dash finish, much better results can be obtained when three coats are applied. Three coats should always be applied when a smooth or float finish is desired.

Finish coat of stucco should be waterproofed with an approved brand of Integral Waterproofing Compound or other approved compound as per directions of manufacturers.

The materials composing the stucco shall consist of:

Materials:

1. Portland cement which has been carefully tested and found to meet the requirements of the American Society of Testing Materials.

2. Sand which is free from organic matter or loam and uniformly graded in size from coarse to fine.

3. Hydrated lime—any good brand of prepared hydrated lime or well burned slacked lime putty will be accepted.

Proportions:

FIRST COAT:—1 cement
1/10 lime
2 sand

SECOND COAT:—1 cement
1/10 lime
2½ sand

THIRD COAT:—1 cement
1/10 lime
3 sand

SPECIFICATIONS FOR FLOOR CONSTRUCTION

General:

Floor construction shall be the type known as the one-way combination hollow tile and concrete floor construction consisting generally of 4-in. reinforced concrete beams spaced 16 in. on centers with Natco structural clay tile between, and covered with concrete top as shown or "Natcoflor" without concrete covering, all to have at least 6-in. bearing on walls.

Concrete:

All concrete used in floor construction shall consist of 1 part portland cement, 2 parts clean sharp sand, and 4 parts broken stone or gravel of such size as will pass through a ¾-in. ring. Concrete will be of wet mixture, and must be well tamped and worked around reinforcing steel after pouring.

Reinforcing Steel:

Bars shall be of a deformed type, meeting the specifications of the A.S.T.M. and of sizes shown on drawings. Before placing into position, bars must be clean and free from rust or scale, adhering material, oil or any other substance tending to destroy the bending qualities.

Tile:

Depth of Natco tile and size of steel reinforcement will be as shown on the plans or as specified by competent engineers for the given spans and loads, etc. All tile must be wet before concrete or grout is placed, so as to insure proper bond with the concrete.

Centers:

Centers must be of such size as to insure of their not deflecting under the weight of the wet materials, and must be provided in such quantity as to insure speedy work. Centers must not be removed before the concrete has properly set, and under long spans a center line of supports must be maintained for at least 3 weeks after the concrete has been poured. In cold weather the centers must be left in place until directed by the architect to remove them.

Natcoflor:

Grout for Natcoflor shall consist of 1 part portland cement to 2½ parts of sand. Specifications for reinforcing steel, tile and centering shall be the same as is given above.

Natco
Vitritile

NATCO FRITTED GLAZE VITRITILE NOW OFFERS A NEW MEDIUM OF EXPRESSION TO ARCHITECTS

Fritted Glaze—A Pledge of Permanence

New fields of color composition, color harmony, are open with the advent of Natco Fritted Glaze Vitritile. The comprehensive line of structural units suitable for interior or exterior walls and partitions, are painted with flame into beautiful luminous matt whites, striking blacks, and delightful and unique mottled effects, ranging through cream tans and cream browns.

Beautiful when installed—the beauty of this new material endures. The Natco Fritted Glaze process, scientifically developed, is a pledge of permanence. The glaze is as permanent as that on the finest English Glazed Brick—the standard of excellence in materials of this type.

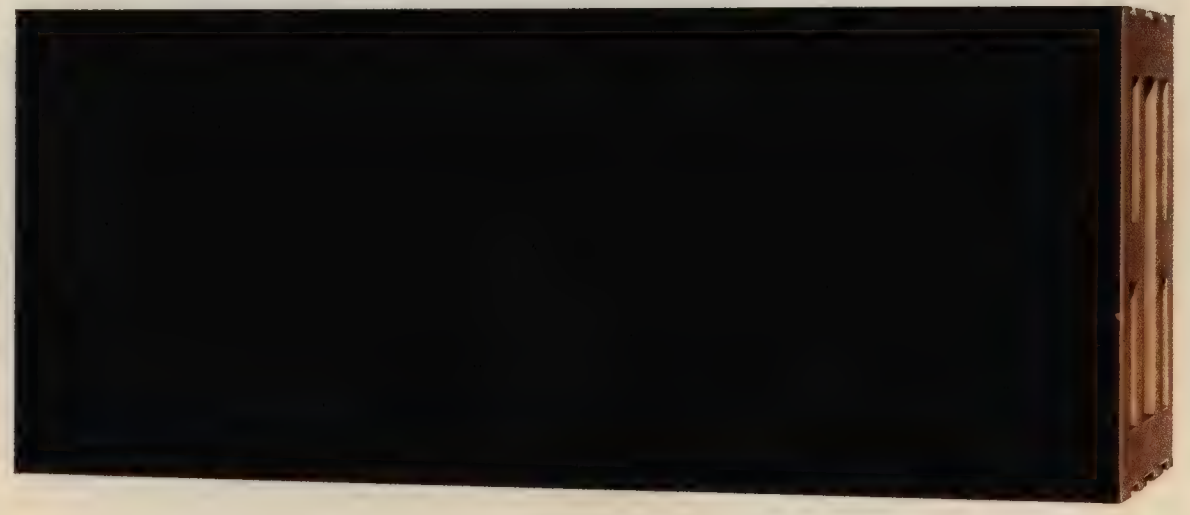
Natco Fritted Glaze represents the successful culmination of a determined attempt to produce a glaze so permanent—so impervious—so free from defacement—so immune to the destructive agencies of time, the elements, chemical attack, staining, checking, and crazing—that it will easily meet the most exacting requirements of the most particular user. The fritted glaze process is the most effective method science has devised of holding crawling, peeling, blistering, cracking and pinholing to a microscopic minimum.

Tests and experiments early disclosed that the ordinary processes of raw mixing, spraying, and kiln-burning which are in common use were powerless to attain these ideals. Only by the scientific fritted glaze process could they be realized.

Natco's frit is made of a number of various compounds, which are mixed, melted at 2300° Fahrenheit, chilled and then ground to an impalpable powder. This powder represents a *new* and homogeneous compound, which melts at a much lower temperature. The successive coats of glaze material (sometimes as many as 7) are applied to the tile on a patented "G Mottling" machine, developed by a ceramic expert. This machine does its work with absolute precision, substituting for the uncertainties of makeshift methods unvarying excellence of results. When the tile is kiln-burned, the frit causes the glaze to mature at a lower temperature; form a more intimate bond with the tile; give—because the various elements have been pre-melted, instead of merely fused, together—more uniform results; and yield a silica glaze equivalent to that on the finest English glazed brick—the accepted standard of excellence.

Colors are prepared in the same painstaking, scientific way. Instead of merely mixing a dye-powder with the glaze, Natco utilizes *calcined* colors; the various compounds required to produce the desired shade are blended, burned, wet-ground and the resulting powder screened, before it is added to the glaze. Color variation is thus reduced to a minimum.

The added care needed, the added expense, of the scientific Natco Fritted Glaze process is abundantly justified in the increased service, the assured satisfaction, the well-founded confidence that Natco's product offers to the user. Fritted glaze is a triumph of the ceramic art, a pledge of permanence to you.

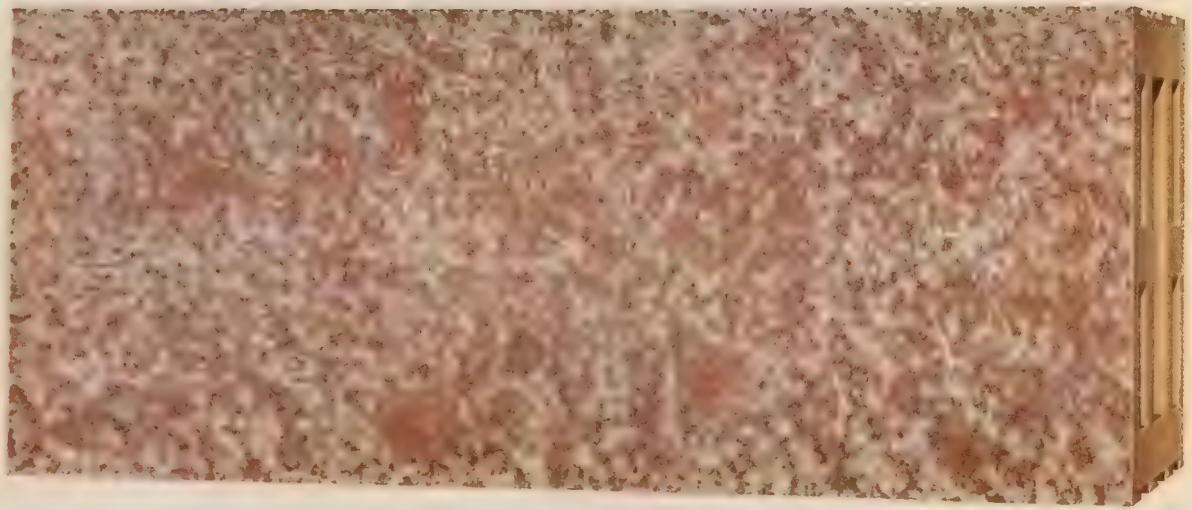


NATCO FRITTED GLAZE VITRITILE—MATT BLACK—No. 6610

NATCO FRITTED GLAZE VITRITILE—MATT WHITE—No. 1500

MOTTLED NATCO VITRITILE—FRITTED GLAZE—MOTTLE No. 8520-S

MOTTLED NATCO VITRITILE—FRITTED GLAZE—MOTTLE No. 8530-S



MOTTLED NATCO VITRITILE—FRITTED GLAZE—MOTTLE No. 8535-L

Walls of Permanent Beauty with NATCO VITRITILE

Fritted Glaze—Salt Glaze

General

Natco Vitritile is an extremely attractive finished face structural fire clay tile for use in both interior and exterior load-bearing and non-load-bearing walls and partitions.

Strength and Insulation

Numerous official tests prove its high crushing strength and adaptability for load-bearing walls, as well as for wall facing. Double shell construction, with its enclosed air spaces, most effectively resists the passage of sound, heat, cold and dampness through the walls.

Accuracy as to Shape and Size

All the tile are selected as to shape and run exceptionally true to size. Each piece leathered or smoothed at the edges, resulting in neat horizontal and vertical mortar joints; ¼″ mortar joints are generally recommended.

Colors and Finishes

The many different finishes and colors in which Natco Vitritile is furnished, greatly increases its field of use. In addition to the salt glaze, it is available in beautiful fritted glaze finishes in straight colors and attractive mottle effects with matt finish.

Fritted Glaze and Salt Glaze Vitritile—These finishes are entirely unaffected by dirt, grease, chemicals and heat—thus are easily cleaned and kept clean.

Sizes of Natco Vitritile

Vitritile in all finishes is manufactured in four different thicknesses, three for wall tile and one for furring as follows:

3¾″ Vitritile, finished one or two sides.
6″ Vitritile, finished, one or two sides.
8″ Vitritile, finished, one side.
Above sizes are also furnished one side scored for plaster.
1⅞″ Vitritile. For furring brick, stone, concrete, etc.

All sizes of Vitritile are furnished select one face, but the 3¾″ and 6″ tile is also furnished select two faces for two-faced partitions of these thicknesses.

Proper shapes are provided for corners, closures, sills, lintels, base and cap to give a pleasing finish to a building. While we have standard shapes to take care of practically every building condition, we are also equipped for special cutting, such as for stair slopes, corners greater than right angles, or the necessary tile to make 2″ or 3″ courses when working up to ceiling lines, etc. Special attention is given to work requiring shapes to take care of such special conditions.

Engineering Service

Our Engineering Department will be glad to recommend the most economical and practical methods of using this material to secure the most attractive results.

Rapid and Economical Construction

In that the 3¾″ x 5″ x 12″ unit is equivalent to approximately three brick, the 6″ x 5″ x 12″ to four and one-half brick, and the 8″ x 5″ x 12″ to six

brick, and are at the same time, quickly and easily handled and laid, considerable time, labor and mortar savings are effected. With each tile laid, a portion of the finished wall is put in place. There is no depreciation—the tile does not disintegrate or weather—there is no painting or other maintenance expense. Plastering is eliminated.

Adaptability

The field for use is practically unlimited. Vitritile is ideal for walls and wainscots in laboratories, schools, airports, restaurants, hotel kitchens and supply rooms, hospitals, gymnasiums, natatoriums, corridors, substations, subways and subway stations, public comfort stations, lavatories, shower rooms, garages, abattoirs, basements, filling stations, etc.

Packing and Shipping

Each tile of the select and of the standard grade is placed in a corrugated paper container and carefully loaded and braced in cars, thus insuring safe arrival at destination. The second quality is packed in straw and lath.

CLASSIFICATIONS AND COLORS

Select Quality

Includes tile free from chips or other imperfections that would affect the appearance of the finished wall. This quality is available in a variety of mottle effects, matt white and matt black in the Fritted Glaze, as well as in three different shade ranges in the Salt Glaze.

Colors

Fritted Glaze—The mottle effects, the luminous matt whites, and the midnight matt blacks, in which Natco Fritted Glaze Vitritile is finished are illustrated in the following pages.

Salt Glaze—Full mingled shade range No. 200 includes all colors from the lighter to the darker, and makes a most pleasing effect. The No. 50, or light shade range, has a slight blending of the lighter colors. In that more pleasing effects are obtained through the use of Natco Salt Glaze Vitritile in blended shades, it is not furnished in uniform colors.

For cove base there is a special chocolate brown dark shade available, known as shade range No. 90. This is desirable where a contrast in color is wanted between the cove base and upper walls. Wainscot cap, sills, etc. can also be furnished in the No. 90 shade when desired. Sufficient time must be allowed to manufacture such items after receipt of order. All shade No. 90 cove base items carried in stock for prompt shipment.

Standard or Commerical Quality—Salt Glaze Only

Includes all tile which, due to slight facial imperfections, cannot be classed as select. No chipped tile, or tile not structurally sound, are included. The full range of color only is furnished in this classification. This grade is suitable for industrial and commercial buildings and similar structures.

Second Quality—Salt Glaze Only

Includes tile with small chips or other facial imperfections, which do not impair the strength of the walls where used. On account of its low price, this grade of Vitritile is especially suitable for use in place of rough finished concrete, brick or tile in foundations, load-bearing walls, etc., where, while the appearance may not be so important, at the same time a sanitary and light colored, permanent surface can be obtained at approximately the same cost. It is not sorted for color.

Directions for Ordering Shapes:

(1) Be sure to order all pieces by number as given under each shape.

(2) Short Lengths—All numbers under shapes in which short lengths are furnished denote 12″ lengths. When ordering shorter lengths give this same number with length wanted. For example, if a 3″ length of V-400 is wanted, mark V-400-3″, or, if the half or 5⅛″ length is desired, order V-400-6″.

(3) 3¾″ corners, jambs, cove base and wainscot caps, etc. (Shapes V-420, V-426, V-430, V-436, V-4100, V-4110, V-4120, V-470 and V-480) will be furnished scored on one side for use with shape V-890 in 3¾″ partition plastered on one side, when so ordered, and when sufficient time is allowed for manufacture. Scored fittings are not ordinarily carried in stock. Be sure to specify whether external or internal side of corners are to be scored.

(4) When ordering corners in one face material (Shapes V-4100, V-4110, V-4120, V-C4700, V-C4710, V-C4720, V-C4800, V-C4810 and V-C4820) of select one face material, do not fail to specify whether the select face is internal or external.

(5) Mitered and other unusual shapes may be procured by special agreement, but must be submitted for approval before ordering.

SPECIFICATIONS FOR NATCO VITRITILE

General:

Where so indicated on plans or called for in the specifications, the interior of certain corridors, rooms, stairways, and elevator shafts shall have walls and partitions built of or faced with Vitritile as manufactured by the National Fireproofing Corporation. Cove base tile shall be used in all rooms having cement or composition floors. All external corners and jambs shall be bullnose with bullnose window sills and (bullnose) (square) lintels. Wainscot tile shall finish (with cap)—(flush with plaster above).

Tile shall be shade range (No. 105 or other color as selected) and be free from spalls or other imperfections which will mar its appearance or durability.

Details:

When requested to do so, the contractor shall submit to the architect for his approval, large scale or full size drawings showing the shapes of tile or the method to be used in its erection.

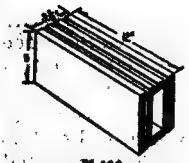
Shapes listed in National Fireproofing Corporation literature will be required to make an all tile finish, although not specifically called for by name.

Mortar and Laying:

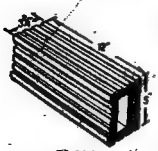
All Vitritile for interior non-load bearing walls or furring shall be laid with ¼″ bed and head joints (unless a slight humoring is necessary to come up to sill or story heights) in mortar composed of 1 part of portland cement, 1¼ part hydrated lime and six parts of well screened sand (or may be written—1 bag portland cement—1—50 lb. bag of hydrated lime—6 cu. ft. of sand). The mortar shall be left natural color—(shall be colored as approved by architect with.....mineral mortar or stain). On completion the tile shall be washed down with clean water and scrubbing brush. In order to prevent injurious effect on the mortar, use no acid, unless absolutely necessary.

Where Vitritile is used in load bearing walls, or for exterior facing, use mortar as specified for such work on page 75 of the Natco Handbook.

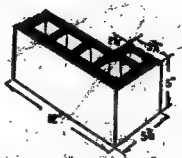
NATCO VITRITILE—3¾" size



V-400
3¾"x5"x12" Wall Stretcher (smooth two sides), also furnished in 2", 3", 4", 5", 6", 8" and 10" lengths

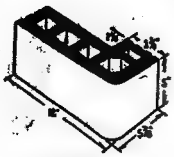


V-800
3¾"x5"x12" Wall Stretcher (smooth one side, scored one side), also furnished in 2", 3", 4", 5", 6", 8", and 10" lengths

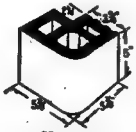


V-4100
3¾"x12"x5" Square External and Internal Corner

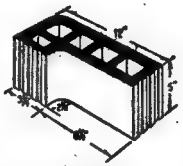
V-4105
3¾"x5¾"x5" Square External and Internal Half Corner



V-4110
3¾"x12x5" Bullnose External and Square Internal Corner

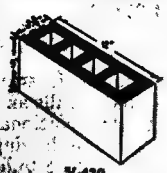


V-4115
3¾"x5¾"x5" Bullnose External and Square Internal Half Corner



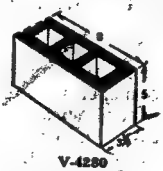
V-4120
3¾"x12"x5" Bullnose External and Coved Internal Corner

V-4125
3¾"x5¾"x5" Bullnose External and Coved Internal Half Corner



V-420
3¾"x12"x5" Square Full Closure

V-426
3¾"x5¾"x5" Square Half Closure

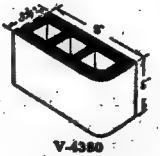


V-4280
3¾"x8"x5" Square Pilaster

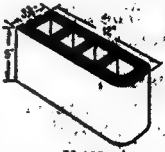
V-C4078
3¾"x5¾"x5" Chamfered Corner

V-430
3¾"x12"x5" Single Bullnose Full Closure

V-436
3¾"x5¾"x5" Single Bullnose Half Closure

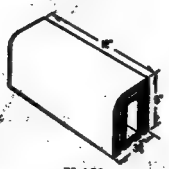


V-4380
3¾"x8"x5" Single Bullnose Pilaster



V-440
3¾"x12"x5" Double Bullnose Full Closure

V-4800
3¾"x5"x12" Square Sill or Ledge Tile. Also furnished in 6" and 8" lengths



V-460
3¾"x5"x12" Single Bullnose Sill or Lintel Tile. Also furnished in 5½" and 8" lengths

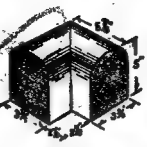
V-4600
3¾"x5"x12" Double Bullnose Coping Tile. Also furnished in 5½" and 8" lengths

V-448
3¾"x5¾"x5" Double Bullnose Half Closure

NATCO VITRITILE—3¾" size

V-S4600

3⅝"x5"x5⅛" Combination Bullnose Sill or Lintel Starter, for use with Bullnose Sills, Lintels and Jambs

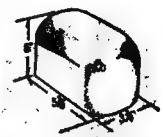


V-C4600

3⅝"x5⅛"x5" Double Bullnose Coping Square External and Internal Corner

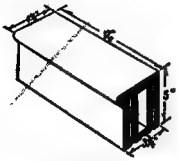
V-C4620

3⅝"x5⅛"x5" Double Bullnose Coping Bullnose External and Coved Internal Corner



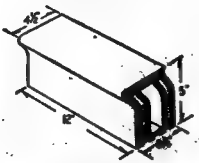
V-C4660

3⅝"x5"x5⅛" Double Bullnose Coping Closure. Used with V-4600



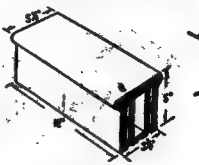
V-480

3⅝"x5"x12" Single Wainscot Cap. Furnished in 2", 3", 4", 5⅛", 8" and 10" lengths



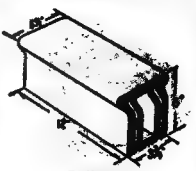
V-K480-R

3⅝"x5"x12" Single Wainscot Cap: coped right (coped left opposite hand). Furnished in 3", 4", 5⅛" and 8" lengths



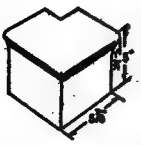
V-4800

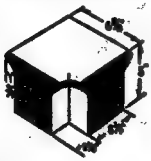
3⅝"x5"x12" Double Wainscot Cap. Furnished in 2", 3", 4", 5⅛", 8" and 10" lengths



V-K4800

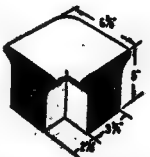
3⅝"x5"x12" Double Wainscot Cap, coped. Furnished in 3", 4", 5⅛" and 8" lengths





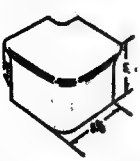
V-C4800

3⅝"x5⅛"x5" Square External and Internal Wainscot Cap Corner



V-C4810

3⅝"x5⅛"x5" Bullnose External and Square Internal Wainscot Cap Corner

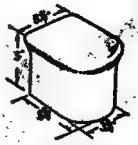


V-C4820

3⅝"x5"x5⅛" Bullnose External and Coved Internal Wainscot Cap Corner. 1½" radius of Internal Cove and Bullnose.

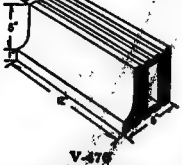
V-S4800

3⅝"x5"x5⅛" Double Wainscot Cap Stop



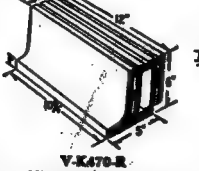
V-S4850

3⅝"x5⅛"x5" Wainscot Cap Double Bullnose Closure



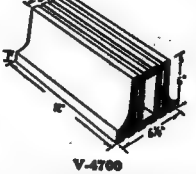
V-470

3⅝"x6"x12" Single Cove Base. Furnished in 2", 3", 4", 5⅛", 8" and 10" lengths



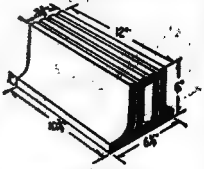
V-K470-R

3⅝"x6"x12" Single Cove Base, coped right (coped left opposite hand). Furnished in 3", 4", 5⅛" and 8" lengths



V-4700

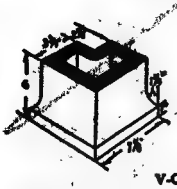
3⅝"x6"x12" Double Cove Base. Furnished in 2", 3", 4", 5⅛", 8" and 10" lengths



V-K4700

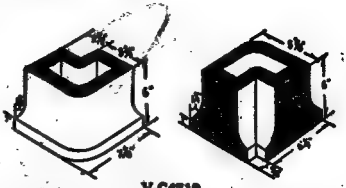
3⅝"x6"x12" Double Cove Base, coped. Furnished in 3", 4", 5⅛" and 8" lengths

NATCO VITRITILE—3¾" and 1⅞" sizes



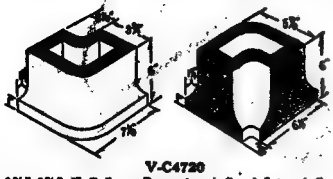
V-C4700

3⅜"x1⅜"x6" Square External and Internal Cove Base Corner



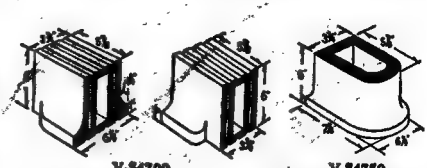
V-C4710

3⅜"x3⅛"x6" Bullnose External and Square Internal Cove Base Corner



V-C4720

3⅜"x3⅜"x6" Bullnose External and Coved Internal Cove Base Corner

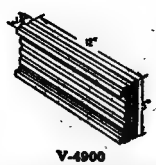


V-S4700

3⅜"x6"x3⅜" Double Cove Base Step

V-S4750

3⅜"x1⅛"x6" Cove Base Double Bullnose Closure



V-4900

1⅜"x5"x12" Furring Stretcher. Also furnished in 3", 3½", 5⅛", 9" and 10" lengths

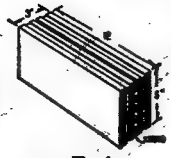
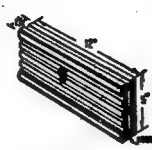


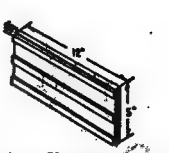
Fig. A

Refer to V-4901 and V-4902 at right



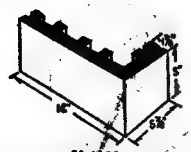
V-4901

1⅛"x5"x12" Slab. Shipped in pairs in single block, which is kerfed to split. (See Fig. A at left.) This slab furnished for use at pipe chases and conduit spaces. Furnished in 6" and 12" lengths only



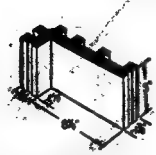
V-4902

⅝"x5"x12" Slab. Shipped in pairs in single block, which is kerfed to split. (See Fig. A and V-4901 at left.) This slab furnished for use at electric conduits and outlets. Furnished in 12" length only



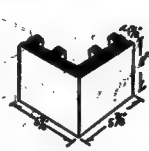
V-4101

1⅜"x1⅝"x5" Furring, Square External Corner



V-4102

1⅜"x1⅛"x5" Furring, Square Internal Corner

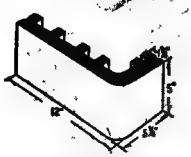


V-4106

1⅜"x1⅜"x5" Furring, Square Half Corner. (External)

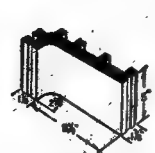
V-4107

1⅜"x2⅛"x5" Furring, Square Half Corner. (Internal)



V-4121

1⅜"x1⅝"x5" Furring, Bullnose External Corner



V-4122

1⅜"x1⅛"x5" Furring, Coved Internal Corner

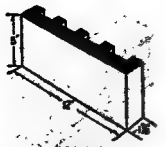
V-4126

1⅜"x1⅜"x5" Furring, Bullnose Half Corner. (External)

V-4127

1⅜"x2⅛"x5" Furring, Coved Half Corner. (Internal)

NATCO VITRITILE—1⅞" size

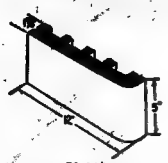


V-421
1⅞"x12"x5" Furring, Square Full Closure

V-427
1⅞"x5⅜"x5" Furring, Square Half Closure

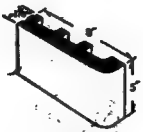
V-4282
1⅞"x8"x5" Furring, Square Pilaster

V-C4076
1⅞"x5⅜"x5" Furring, Chamfered Corner. (External)

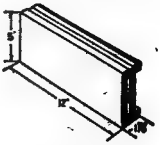


V-441
1⅞"x12"x5" Furring, Bullnose Full Closure

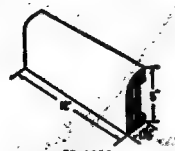
V-447
1⅞"x5⅜"x5" Furring, Bullnose Half Closure



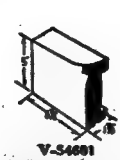
V-4382
1⅞"x8"x5" Furring, Bullnose Pilaster



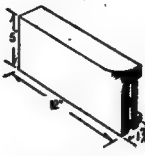
V-4501
1⅞"x5"x12" Furring, Square Sill or Lintel Tile. Also furnished in 5⅜" and 8" lengths. (Note: one face and one edge finished)



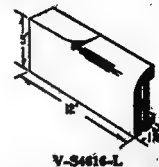
V-4601
1⅞"x5"x12" Furring, Bullnose Sill or Lintel. Also furnished in 5⅜" and 8" lengths



V-S4601
1⅞"x5"x5⅜" Furring, Bullnose Sill or Lintel Starter, left hand. (Right hand opposite)



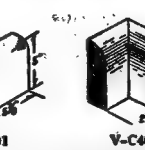
V-S4611-L
1⅞"x5"x12" Furring, Bullnose Sill or Lintel Starter, end type, left hand. (Right hand opposite)



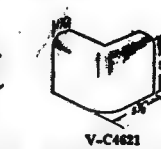
V-S4616-L
1⅞"x5"x12" Furring, Bullnose Sill or Lintel Starter, coped type, left hand. (Right hand opposite)

V-S4612
1⅞"x5"x5¾" Furring, Bullnose Sill Starter (for 1¾" Sill) left hand. (Right hand opposite)

V-S4614
1⅞"x5"x5¾" Furring, Bullnose Sill Starter (for 3¼" Sill) left hand. (Right hand opposite)



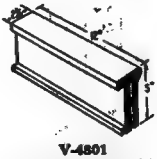
V-C4601
1⅞"x5¾"x5" Furring, Bullnose Coping, Square External Corner



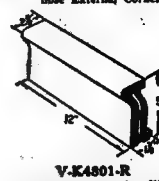
V-C4602
1⅞"x2¼"x5" Furring, Bullnose Coping, Square Internal Corner

V-C4622
1⅞"x2¼"x5" Furring, Bullnose Coping, Coved Internal Corner

V-C4661
1⅞"x5"x5⅜" Furring, Bullnose Coping Closure, left hand. (Right hand opposite)



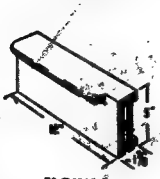
V-4801
1⅞"x5"x12" Furring Wainscot Cap. Furnished in 2", 3", 4", 5⅜", 8" and 10" lengths



V-K4801-R
1⅞"x5"x12" Furring Wainscot Cap, coped right. (Coped left opposite hand.) Furnished in 3", 4", 5⅜" and 8" lengths

NATCO VITRITLE—1⅞" size

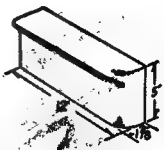
V-S4801
1⅜"x5"x5⅜" Furring, Wainscot Cap Stop, square open end, right hand. (Left hand opposite)



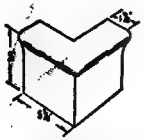
V-S4811-L
1¼"x5"x12" Furring, Wainscot Cap Stop, square, open end, left hand. (Right hand opposite)

V-S4851
1⅜" x 5⅜" x 5" Furring, Wainscot Cap Bullnose Closure, left hand. (Right hand opposite)

V-S4861
1⅜" x 5⅜" x 5" Furring, Wainscot Cap Bullnose Stop, left hand. (Right hand opposite)

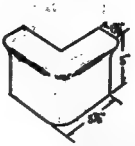


V-S4812-L
1¼"x5"x12" Furring, Wainscot Cap Bullnose Stop, left hand. (Right hand opposite)



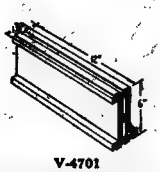
V-C4801
1⅜"x5¾"x5" Furring, Wainscot Cap Square External Corner

V-C4802
1⅜"x2½"x5" Furring, Wainscot Cap Square Internal Corner

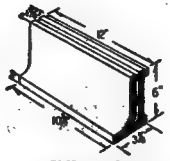


V-C4821
1⅜"x5¾"x5" Furring, Wainscot Cap Bullnose External Corner

V-C4822
1½"x2½"x5" Furring, Wainscot Cap Coved Internal Corner. 1½" radius of Internal Cove.



V-4701
1⅜"x6"x12" Furring, Cove Base. Furnished in 2", 3", 4", 5⅜", 6" and 10" lengths

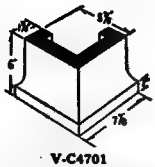


V-K4701-R
1⅜"x6"x12" Furring, Cove Base, coved right (coped, left opposite, hand.) Furnished in 3", 4", 5⅜" and 6" lengths

V-S4701
1⅜"x6"x5⅜" Furring, Cove Base Stop, square open end, right hand. (Left hand opposite)

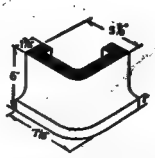
V-S4781
1⅜"x5⅜"x5" Furring, Cove Base Bullnose Closure, left hand (Right hand opposite)

V-S4781
1⅜"x5⅜"x6" Furring Cove Base Stop, Bullnose, left hand. (Right hand opposite)



V-C4701
1⅜"x5¾"x5" Furring, Cove Base Square External Corner

V-C4702
1⅜"x2⅜"x6" Furring, Cove Base Square Internal Corner



V-C4721
1⅜"x1⅝"x6" Furring, Cove Base Bullnose External Corner

V-C4722
1½"x2½"x6" Furring, Cove Base Coved Internal Corner. 1½" radius of Internal Cove.

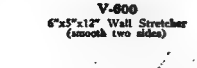
NATCO VITRITILE—6″ and 8″ sizes

No special fittings are required for the 6″ walls. Use the 1⅞″ and 3¾″ size fittings together.

V-600
6″x5″x12″ Wall Stretcher (smooth two sides)

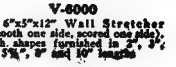
Natco Vitritile 6″ Partitions are especially suitable for elevators and stairway enclosures.

V-6000
6″x5″x12″ Wall Stretcher (smooth one side, scored one side). Both shapes furnished in 2″, 3″, 4″, 5⅜″, 8″ and 10″ lengths



V-800
8″x5″x12″ Wall Stretcher (smooth two sides)

V-810
8″x12″x5″ Square Corner



V-811
8″x12″x5″ Bullnose Corner

V-8000
8″x5″x12″ Wall Stretcher (smooth one side, scored one side). Both shapes furnished in 2″, 4″, 5⅜″ and 8″ lengths

V-820
8″x12″x5″ Square Full Closure

V-826
8″x5⅜″x5″ Square Half Closure

V-830
8″x12″x5″ Bullnose Full Closure

V-836
8″x5⅜″x5″ Bullnose Half Closure

V-866
8″x5″x12″ Square Sill or Lintel. Also furnished in 5⅜″ and 8″ lengths

V-860
8″x5″x12″ Bullnose Sill or Lintel. Also furnished in 5⅜″ and 8″ lengths

DETAILS OF DIFFERENT WIDTHS OF WALL SECTIONS

Fig. 1

Two faced 3¾" Vitritile wall (V-400) showing use of double cove base

Fig. 2

Two faced 3¾" Vitritile wall showing use of double cove base. Double wainscot cap used as chair rail

Fig. 3

Two faced 3¾" Vitritile wall showing double cove base. Double wainscot cap used near ceiling

Fig. 4

3¾" Vitritile wall (V-890) plastered one side, showing single Vitritile cove base and terrazzo base opposite

DETAILS OF DIFFERENT WIDTHS OF WALL SECTIONS

Fig. 5

4⅛" Vitritile two faced wall, illustrating the adaptability of Vitritile where plaster above begins at different elevations on opposite sides

Fig. 6

4⅛" Vitritile two faced wall (V-4900) wainscot effect. Wainscot cap used as chair rail

Fig. 7

6" Vitritile wall (V-890 and V-4900 bonded)

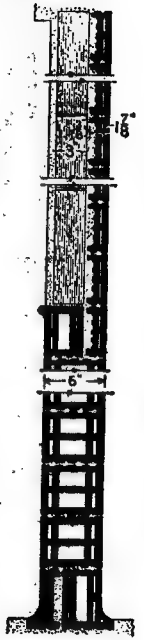


Fig. 8

6" Vitritile wall (V-600) with plaster one side above chair rail

DETAILS OF DIFFERENT WIDTHS OF WALL SECTIONS

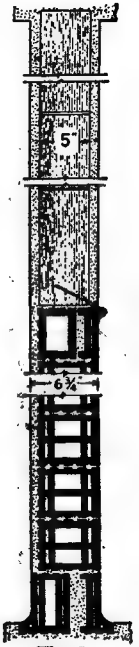


Fig. 9

6" Vitritile wall (V-6000) illustrating wide adaptability of Vitritile to secure any desired effect

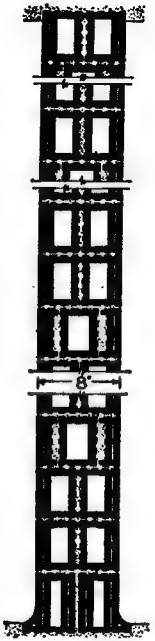


Fig. 10

8" Vitritile wall (V-890 and V-4900 bonded)

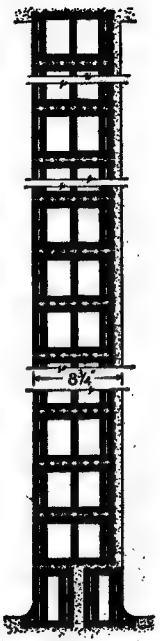


Fig. 11

8" Vitritile wall (V-8000) plastered one side

DETAILS OF DIFFERENT WIDTHS OF WALL SECTIONS

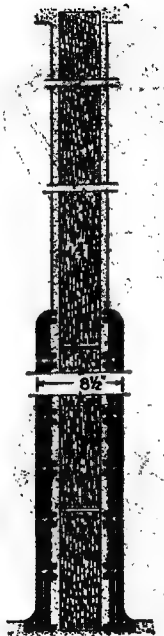


Fig. 12
1⅝" Vitritile furring used as wainscoting

Fig. 13
10" Vitritile wall (V-600 or 6000 and V-890 bonded)

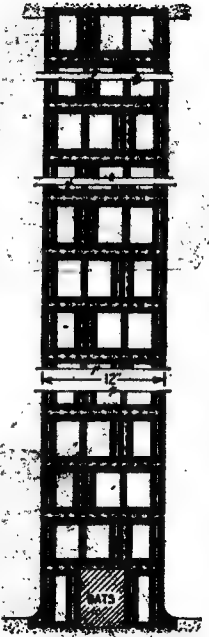


Fig. 14
12" Vitritile wall (V-800 or 8000 and V-890 bonded)

DETAILS OF VITRITILE CONSTRUCTION

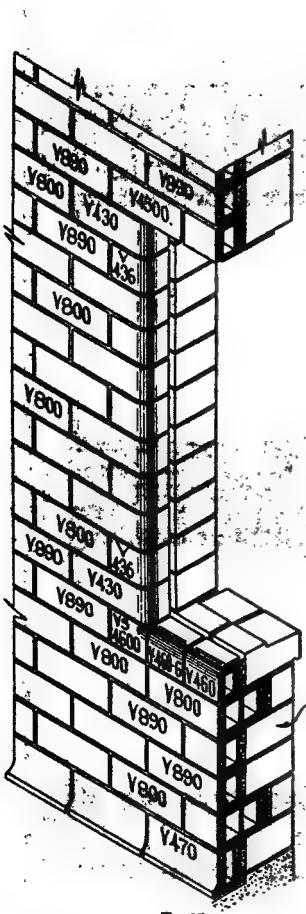


Fig. 15

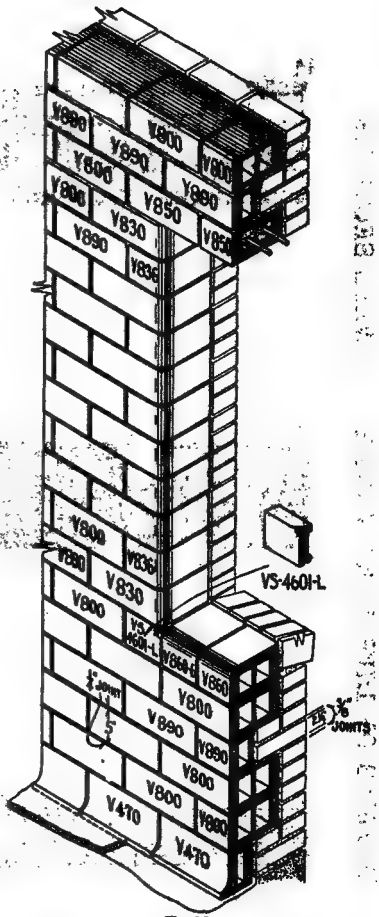


Fig. 16

Figs. 15 and 16 illustrate clearly how Vitritile is used as the structural part of exterior walls. Fig. 15 shows its use in connection with Natco Tex-Tile or Natco Glazed or Unglazed Combed Face Tile. Fig. 16 illustrates the same construction with an exterior of brick. Note perfect bond for maximum strength.

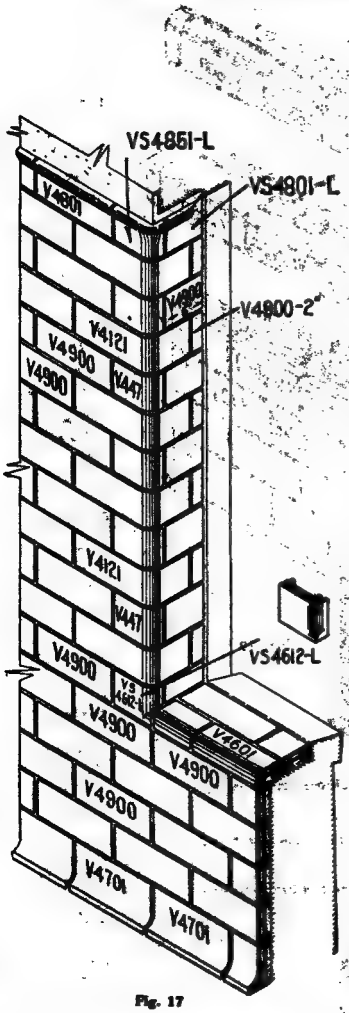


Fig. 17

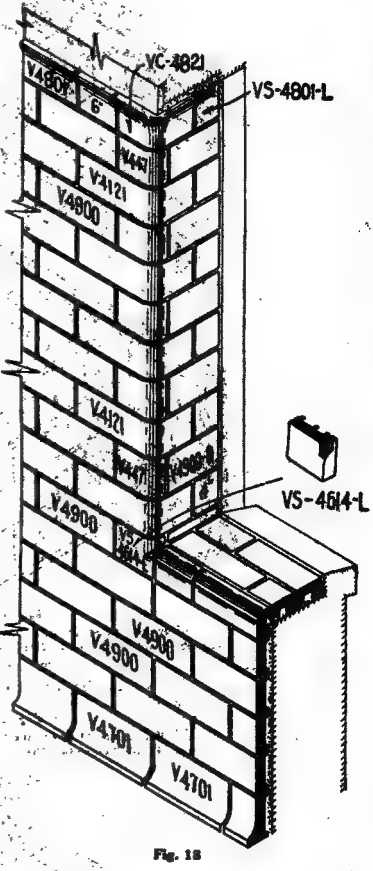


Fig. 18

Figs. 17 and 18 illustrate the use of Natco Vitrilile Furring. Note attractive effects produced by use of bullnose jambs and sills. Choice of sills 1⅞", 3¼" or 5" high is made possible by three standard heights of sill starters, namely VS-4612, VS-4614 or VS-4601. This is very helpful in connection with the question of heights of sills from floors. See also Fig. 16 for VS-4601-L.

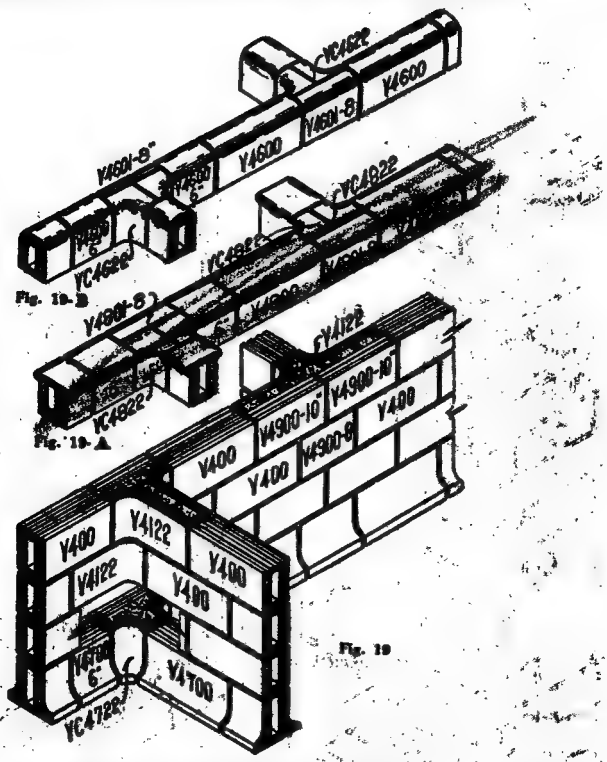


Fig. 19-B

Fig. 19-A

Fig. 19

Fig. 19-B

Alternate construction showing bullnose coping as top course for low partitions. See Fig. 19.

Fig. 19-A

Wainscot capping used as top course of low partitions. See Fig. 19.

Fig. 19

Illustrates use of cove internal corners in two faced partitions. Bonded cross partition.

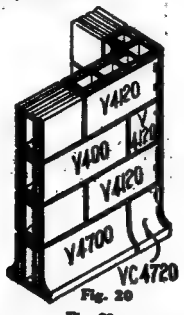


Fig. 20

Fig. 20

Illustrates use of cove internal and bullnose external corners in two faced partitions.

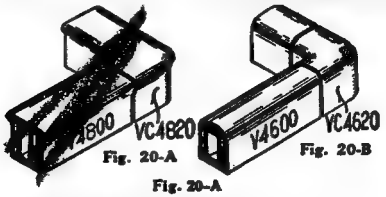


Fig. 20-A

Fig. 20-B

Fig. 20-A

Wainscot capping used as top course of low partitions. See Fig. 20.

Fig. 20-B

Alternate construction showing bullnose coping as top course of low partitions. See Fig. 20.

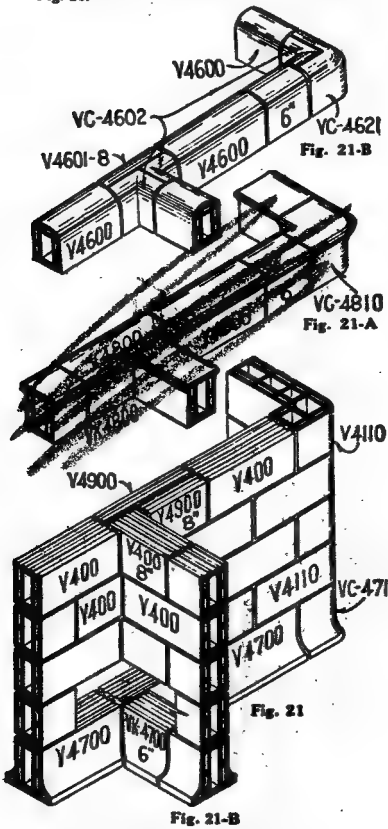


Fig. 21-B

Fig. 21-A

Fig. 21

Fig. 21-B

Alternate construction showing bullnose coping as top course for low partitions. See Fig. 21.

Fig. 21-A

Wainscot capping used as top course of low partitions. See Fig. 21.

Fig. 21

Illustrates use of square internal and bullnose external corners in two faced partitions. Bonded cross partition.

DETAILS OF VITRITILE CONSTRUCTION

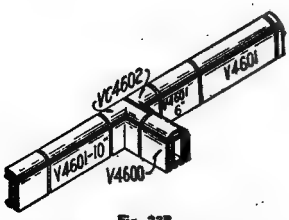


Fig. 22B
Alternate construction showing bullnose capping used in connection with construction as shown in Fig. 22 below

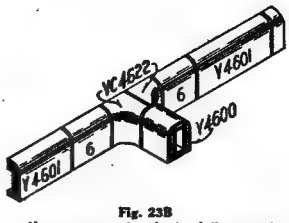


Fig. 23B
Alternate construction showing bullnose capping used in connection with construction as shown in Fig. 23 below

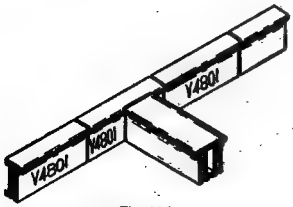


Fig. 22A
Wainscot capping used in connection with construction as shown in Fig. 22 below

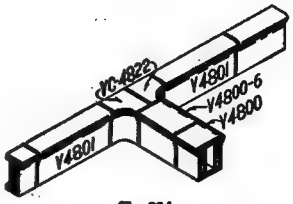


Fig. 23A
Wainscot capping used in connection with construction as shown in Fig. 23 below

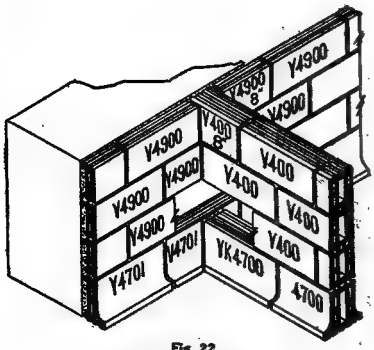


Fig. 22
Shows method of bending partitions into furred walls—square internal corners

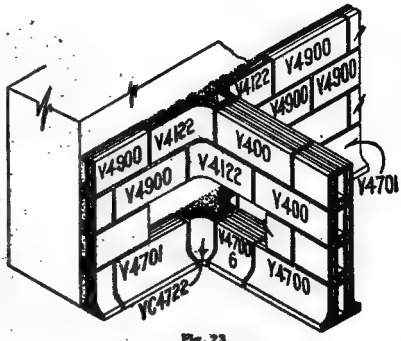


Fig. 23
Shows method of bending two faced partitions into furred walls—coved internal corners

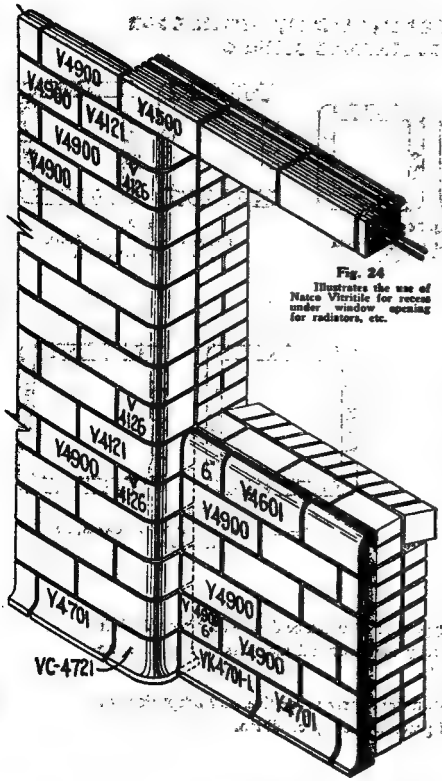


Fig. 24
Illustrates the use of Nasco Vitritile for recess under window opening for radiators, etc.

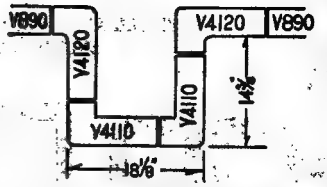
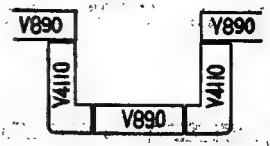


Fig. 26
One course shown—reverse for alternate courses



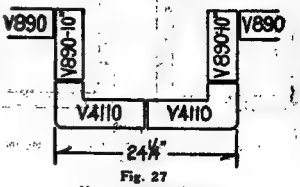
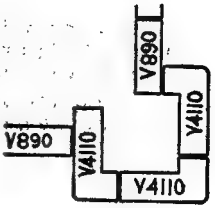


Fig. 27
Alternate courses shown

Figs. 25 to 28, inclusive, show typical arrangements of 3¾" Vitritile for enclosing steel columns in exterior walls.



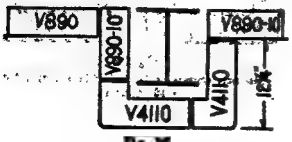


Fig. 25
One course shown, reverse for alternate course

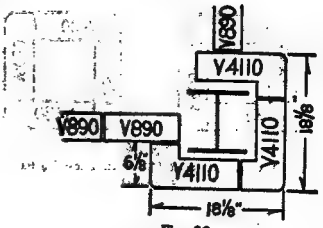


Fig. 28
Alternate courses shown

DETAILS OF VITRITILE CONSTRUCTION

TYPICAL ARRANGEMENT OF 1⅞" AND 3¾" VITRITILE FOR ENCLOSING FREE STANDING COLUMNS

Fig. 29
Alternate courses of 1⅞" Vitritile covering for 8" column

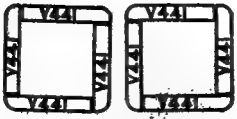


Fig. 30
Alternate courses of 1⅞" Vitritile covering for 10" column

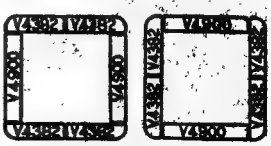


Fig. 31
Alternate courses of 1⅞" Vitritile covering for 12" column

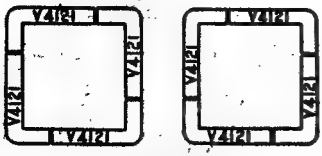


Fig. 32
Alternate courses of 1⅞" Vitritile covering for 14" column

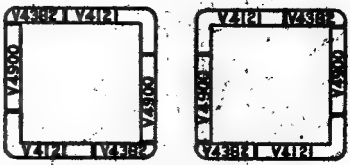


Fig. 33
Alternate courses of 1⅞" Vitritile covering for 16" column

Illustrations on this page are typical of what can be done with Natco Vitritile to fireproof and permanently beautify the structural members of buildings, no matter what the construction may be.

The types of construction shown are simply suggestive, and adaptations of them can be made to take care of practically every condition.

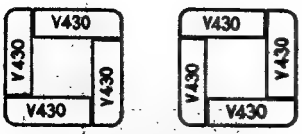


Fig. 34
Alternate courses of 3¾" Vitritile covering for 8" column

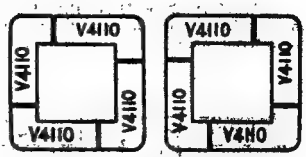


Fig. 35
Alternate courses of 3¾" Vitritile covering for 10" column

TWO-FACED PARTITIONS OF VARIOUS THICKNESSES WITH SQUARE INTERNAL CORNERS AND BULLNOSE EXTERNAL CORNERS

(NOTE: Wainscot cap course similar to "A" course)

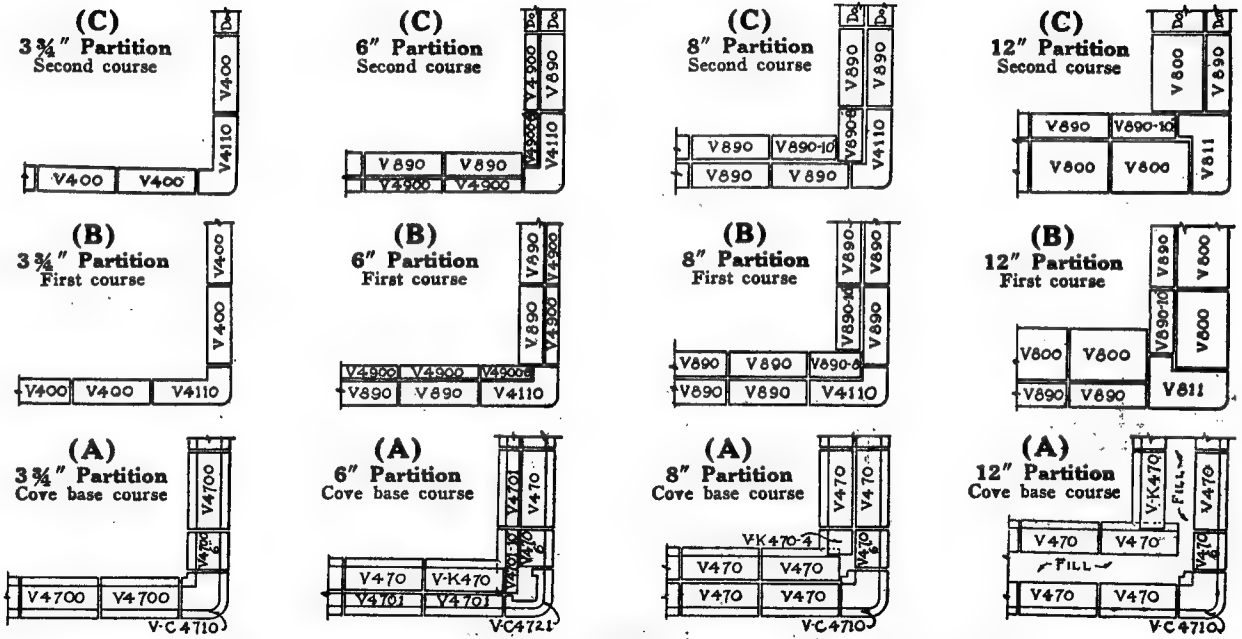


Fig. 36

TWO-FACED PARTITIONS OF VARIOUS THICKNESSES WITH COVED INTERNAL CORNERS AND BULLNOSE EXTERNAL CORNERS

(NOTE: Wainscot cap course similar to "A" course)

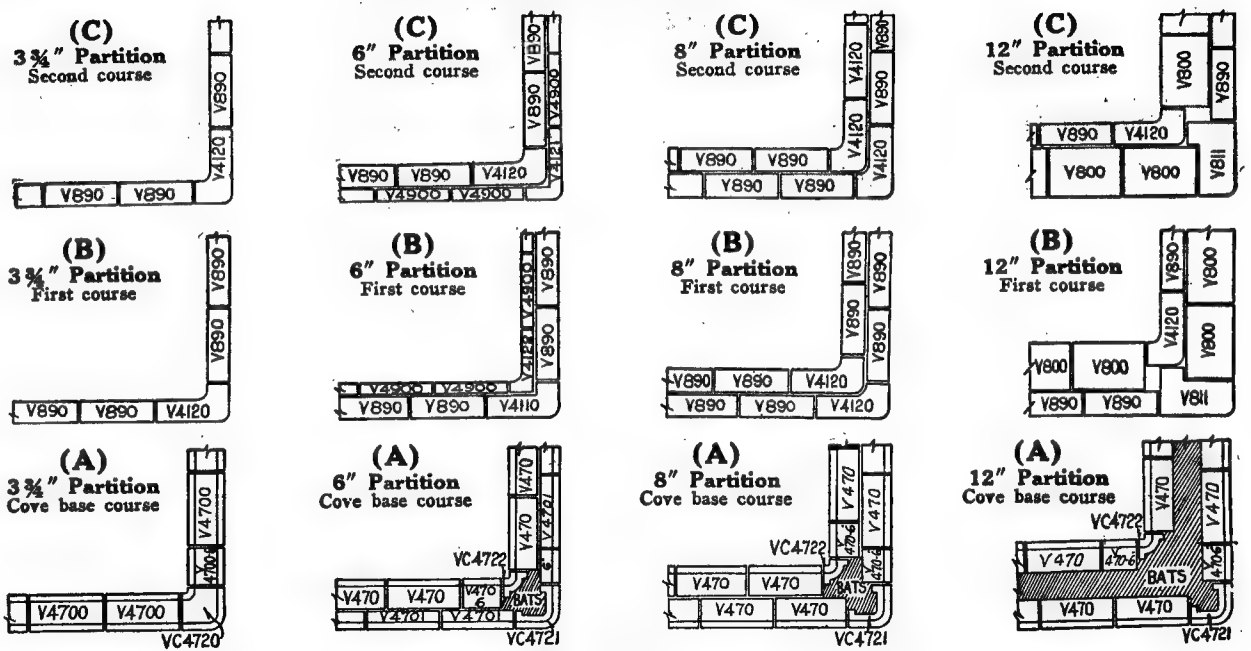


Fig. 37

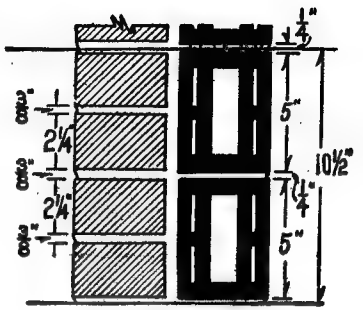


Fig. 38

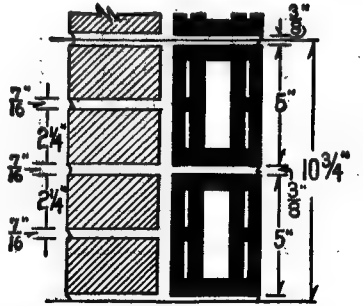


Fig. 39

Typical Relationship Between Brick and Tile Mortar Joints

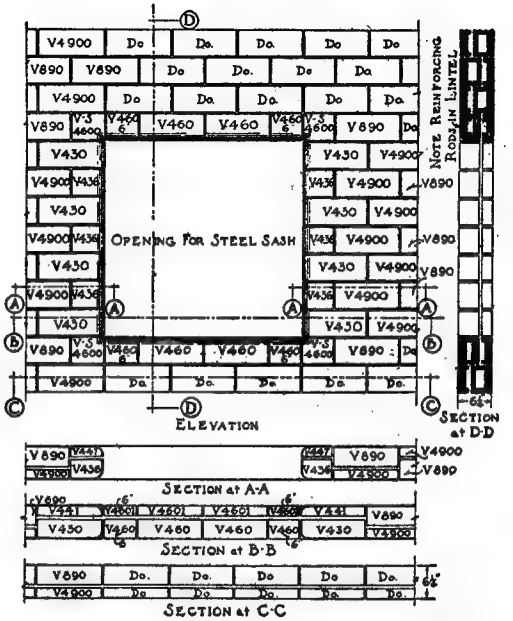


Fig. 40

Treatment of Openings in 6" Natco Vitritile Partition for Steel Sash

Illustration shows use of bullnose sills, lintels and jambs; V-600 or V-6000 may be used in place of V-890 and V-4900

HEIGHT TABLE

Tile { 3¾″ x 5″ x 12″ / 8″ x 5″ x 12″ }
Joints ¼″

Course No.	Height
1	— 5¼″
2	—10½″
3	1′— 3¾″
4	1′— 9″
5	2′— 2¼″
6	2′— 7½″
7	3′— 0¾″
8	3′— 6″
9	3′—11¼″
10	4′— 4½″
11	4′— 9¾″
12	5′— 3″
13	5′— 8¼″
14	6′— 1½″
15	6′— 6¾″
16	7′— 0″
17	7′— 5¼″
18	7′—10½″

The table above is used to determine the heights of walls which will best lay up without cutting tile, using ¼″ bed joints. For instance, should you desire to build a wall 7′–0″ high you will note that it will require 16 courses.

By varying the thickness of the mortar joints these dimensions may be slightly changed.

LENGTH TABLE

Tile { 3¾″ x 5″ x 12″ / 8″ x 5″ x 12″ }
Joints ¼″

No. Tile	Length
1	1′—0″
1½	1′—6⅛″
2	2′—0¼″
2½	2′—6⅜″
3	3′—0½″
3½	3′—6⅝″
4	4′—0¾″
4½	4′—6⅞″
5	5′—1″
5½	5′—7⅛″
6	6′—1¼″
6½	6′—7⅜″
7	7′—1½″
7½	7′—7⅝″
8	8′—1¾″
8½	8′—7⅞″
9	9′—2″
9½	9′—8⅛″

The table above shows the length of walls and pilasters that will best lay up without cutting tile, using ¼″ vertical mortar joints. For instance, should you desire a wall 9′–2″ long you will note that it will require 9 tile.

To find width of openings, add two mortar joints or ½″ to each dimension above.

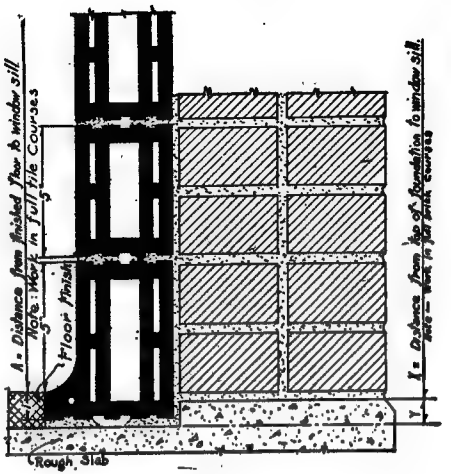


Fig. 41

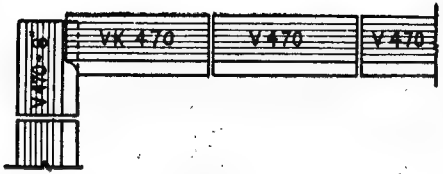
Suggestions for Starting Natco Vitritile Cove Base from Masonry Foundation

(1) Establish sill height (A) above the finished floor in full courses of tile.

(2) Having sill length (A) and thickness of brick courses, distance (X) can be determined.

(3) With top of foundation fixed, figure distance (Y) to suit thickness of floor finish.

Note. Illustration shows ¼″ joints in Vitritile and ⅜″ exterior brick joints.



Left
Plan and Elevation of Intersection of 3¾" Single Cove Base, showing use of coped cove base, V-K470. (left hand.)

Fig. 42

Right
Plan and Elevation of Intersection of 3¾" Single Wainscot Cap showing use of coped wainscot cap, V-K480 (left hand).

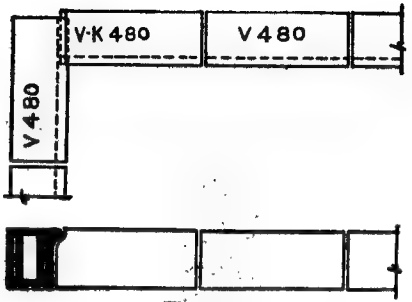
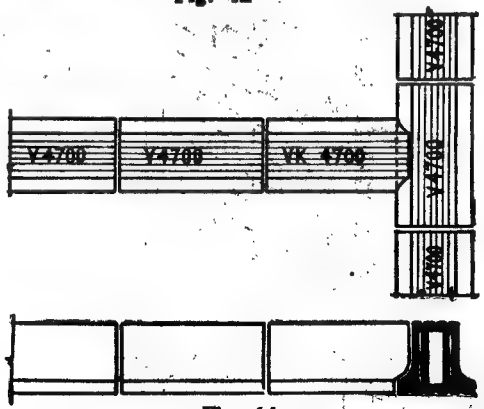


Fig. 43



Left
Plan and Elevation of Intersection of 3¾" Double Cove Base showing use of coped cove base, V-K4700.

Fig. 44

Right
Plan and Elevation of Intersection of 3¾" Double Wainscot Cap showing use of coped wainscot cap, V-K4800.

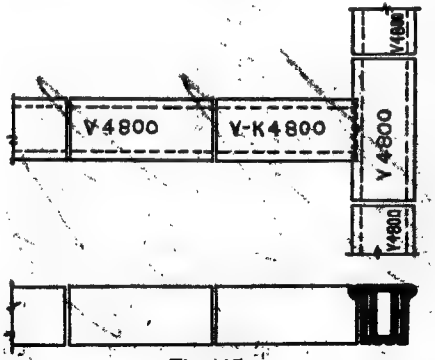
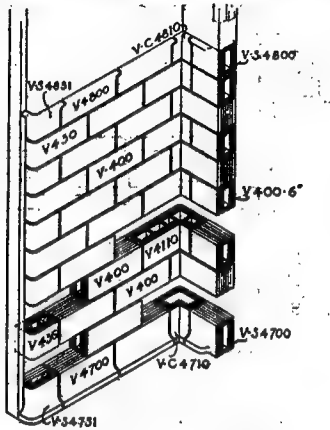


Fig. 45

DOOR CONSTRUCTION—TWO-FACE PARTITIONS

3¾" double-faced partition showing three types of door construction. Note use of various types of door stops and method of filling jamb tiles with mortar at door at left to stiffen the construction.



At left hand, door stops VS-4761 and VS-4861 may be used instead of VS-4751 and VS-4851 respectively.

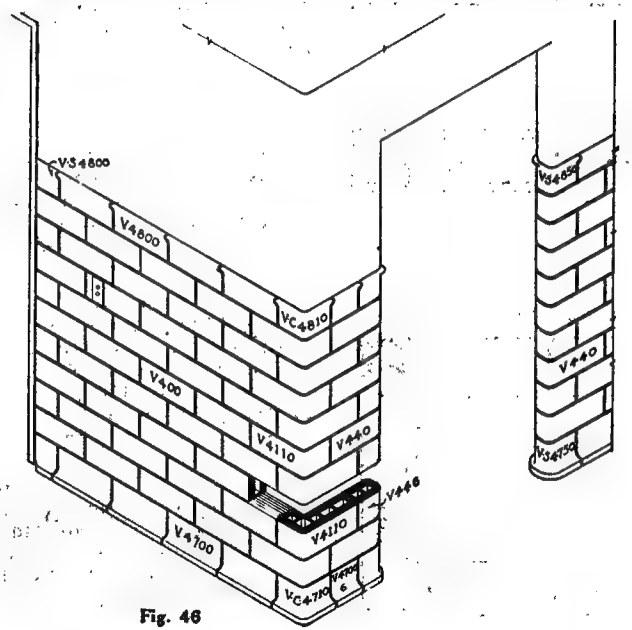


Fig. 46

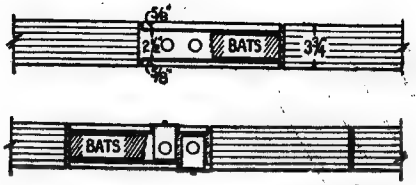


Fig. 47

Illustrates the use of V-4902 for working around electrical conduit in 3¾" two faced wall

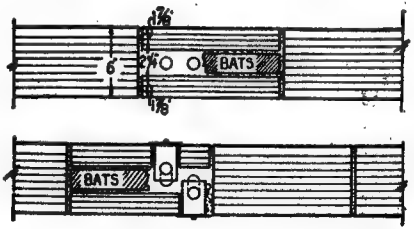


Fig. 48

Illustrates the use of V-4900 for working around electrical conduit in a 6" wall

Figs. 47 to 51 inclusive show method of enclosing electric conduit and fittings, also water, vent and soil pipes within Vitritile walls. Space is obtained by use of 5/8", 1½" and 1⅞" thickness of Vitritile as may be necessary to face the wall at the conduit or piping.

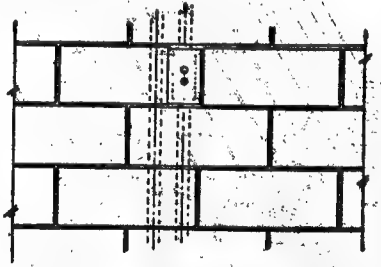


Fig. 51

Shows flush plate in place. Dotted lines indicate conduits

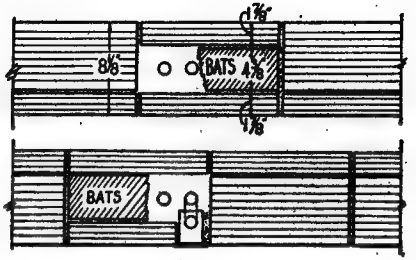


Fig. 49

Illustrates the use of V-4900 for working around electrical conduits in 8⅛" wall of bonded V-600's and V-4900's

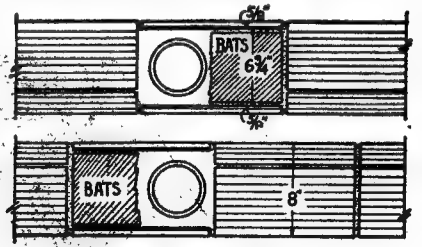


Fig. 50

Illustrates the use of V-4902's for taking care of large pipes in 8" walls of bonded V-600's or 6000's and V-4900's

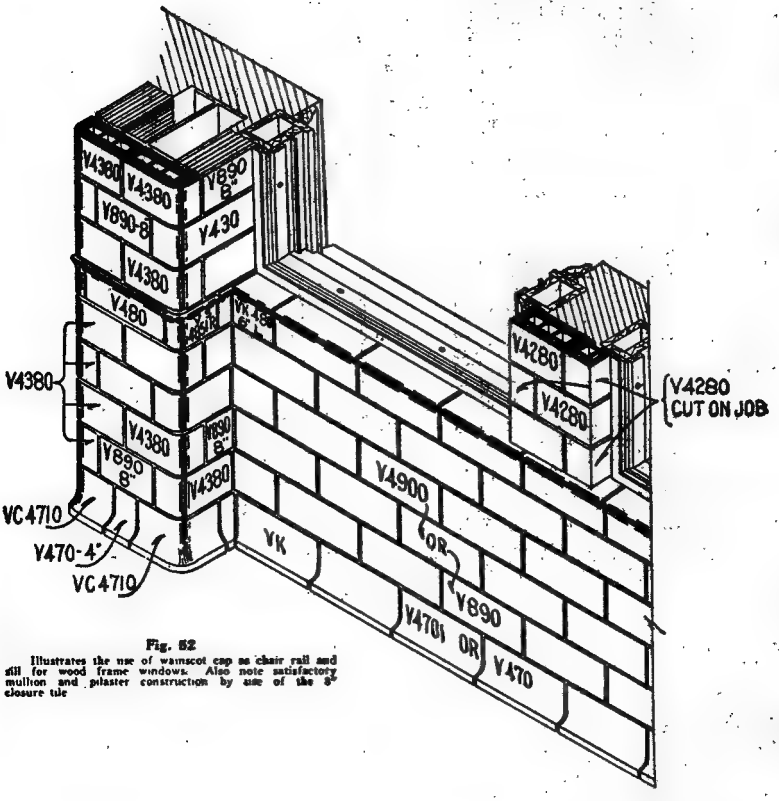
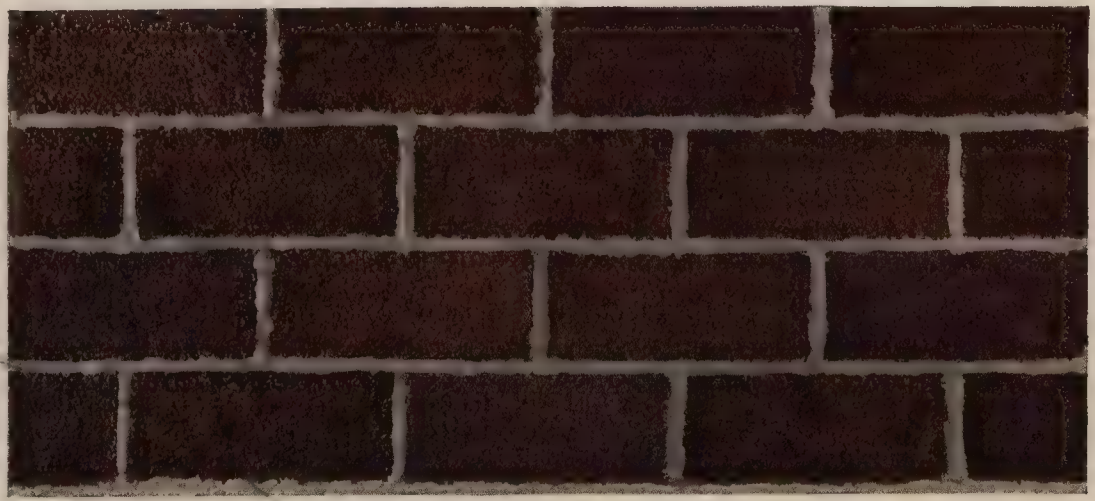


Fig. 52

Illustrates the use of wainscot cap as chair rail and sill for wood frame windows. Also note satisfactory mullion and pilaster construction by use of the 8" closure tile

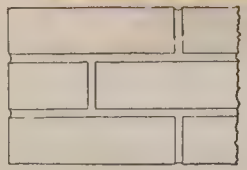
Natco
Face Tile



NATCO MINGLED-SHADE TEX-TILE. RANGE E-1

Bricks drawn in actual ratio to the tile, so that the proportions may be compared.

NATCO MINGLED-SHADE TEX-TILE. RANGE E-2



Bricks drawn in actual ratio to the tile, so that the proportions may be compared.

NATCO MINGLED-SHADE TEX-TILE. RANGE E-3

Bricks drawn in actual ratio to the tile, so that the proportions may be compared.

NATCO GLAZED TEX-TILE

Bricks drawn in actual ratio to the tile, so that the proportions may be compared.

NATCO DOUBLE SHELL FACE TILE

General:

Natco Double Shell Face Tile (Load Bearing) provides a most economical form of masonry construction. The wide double shells make it easy to spread mortar on both the horizontal and vertical mortar joints. The voids in the double shell key with the mortar adding strength and stability to the wall.

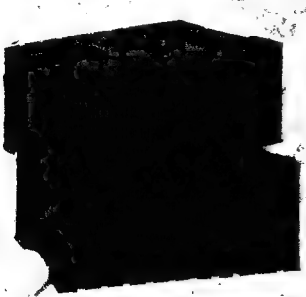
Each tile laid forms a section of an insulated moisture resisting wall, with an attractively finished exterior face. Upkeep is negligible, as the tile does not discolor, disintegrate or weather—obviously painting or similar maintenance is eliminated.

Each unit is equivalent to six brick, easily and quickly laid, effecting considerable labor and mortar savings.

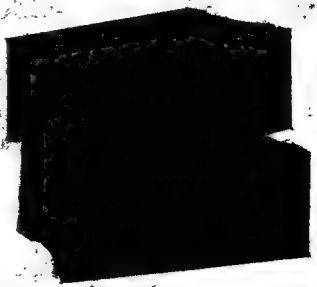
Made with a 5″x12″ face for 8″ walls, complete with all accessory shapes for sills, jambs, lintels, etc.

To appear to best advantage, Natco Tex-Tile should be set in ⅜″ mortar joints.

When thus laid, 2.15 tile builds up approximately one square foot of wall surface. In designing buildings, it is an easy matter to locate openings, etc., so as to employ the standard units, which are made in two lengths, 12″ and 5¾″.



Natco Tex-Tile
Furnished with outside face either unglazed or glazed with the inside face scored for plaster.



Natco Combed Face Tile
Furnished with outside face glazed and the inside face smooth glazed for exposed interior finish.

Unglazed Tex-Tile (Designated by T):

Natco Unglazed Tex-Tile has a texture face resembling a high quality tapestry brick. To meet individual preferences, it is furnished in three (3) color combinations. These are termed Shade Ranges E-1, E-2 and E-3. In Shade Range E-1, the browns predominate. In Shade Range E-3 the reds predominate. In Shade Range E-2 a combination (full range) of Shade Ranges E-1 and E-3 is obtained which is extremely beautiful. The inside face is scored for plaster.

Glazed Tex-Tile (Designated by TG):

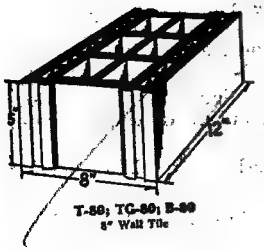
Natco Glazed Tex-Tile has the same texture finish as the unglazed and is furnished in dark brownish shades. The inside face is scored for plaster.

Glazed Combed Face Tile (Designated by B):

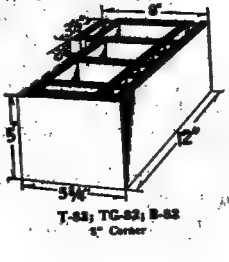
Natco Glazed Combed Face Tile has an exterior scratched or combed face and a glazed smooth, sanitary, easily cleaned interior surface.

(When desired, it can be furnished with unglazed, combed exterior and combed interior faces.)

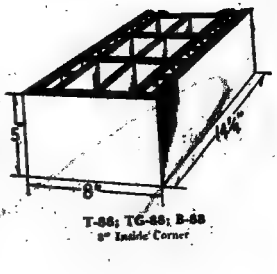
NATCO DOUBLE SHELL FACE TILE



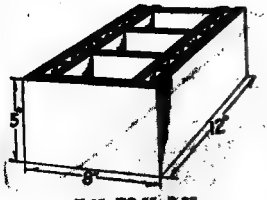
T-50; TG-50; B-50
8" Wall Tile



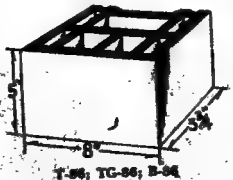
T-52; TG-52; B-52
8" Corner



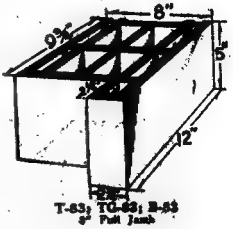
T-58; TG-58; B-58
8" Inside Corner



T-55; TG-55; B-55
8" Closure

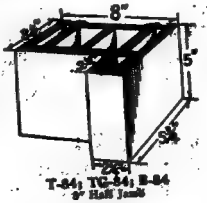


T-56; TG-56; B-56
8" Half Closure

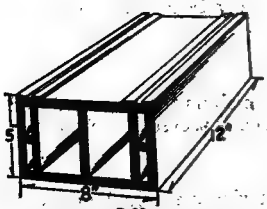


T-53; TG-53; B-53
8" Pull Jamb

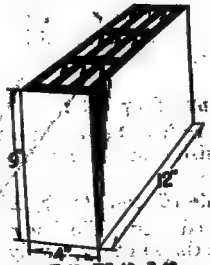
T-41; TG-41; B-41
1" x 4" x 12" Joist Bearing Plate



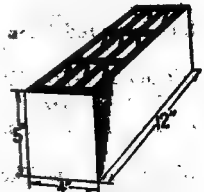
T-54; TG-54; B-54
8" Half Jamb



B-59
8" Straight Lintel
Furnished in Combed Face only. (See T-59, TG-59.

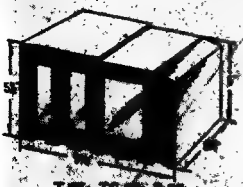


T-49; TG-49; B-49
4" Joist Filler

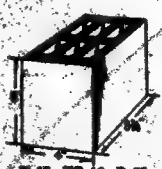


T-40; TG-40; B-40
4" Joist Closure

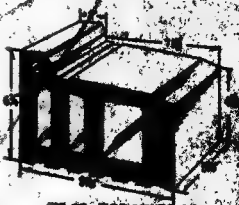
NATCO DOUBLE SHELL FACE TILE



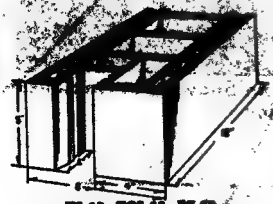
T-47; TG-47; B-47
8" End Tile



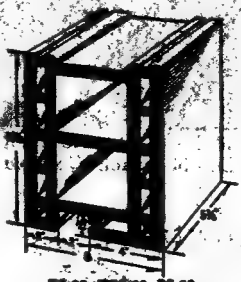
T-46; TG-46; B-46
Plaster Tile



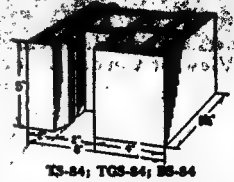
TS-67; TGS-67; BS-67
8" Lin for Steel Sash



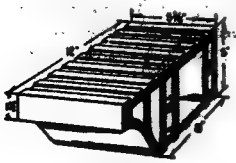
TS-83; TGS-83; BS-83
8" Full Jamb for Steel Sash and for Box Frame Windows and Doors



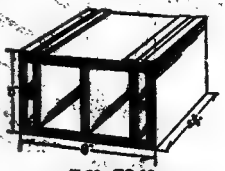
TS-80; TGS-80; BS-80
8" Soldier Lintel for Steel Sash (Note: This lintel is also used extensively with wood frame windows and for outdoor entrance)



TS-84; TGS-84; BS-84
8" Half Jamb for Steel Sash and for Box Frame Windows and Doors



B-812
Corbel Tile
Made in glazed or unglazed combed face only



T-89; TG-89
8" Straight Lintel. See B-89, Page 52. Furnished in Tex-Tile only

View of Corner Section of Natco Double Shell Tile Showing Advantages of Double Shell Construction

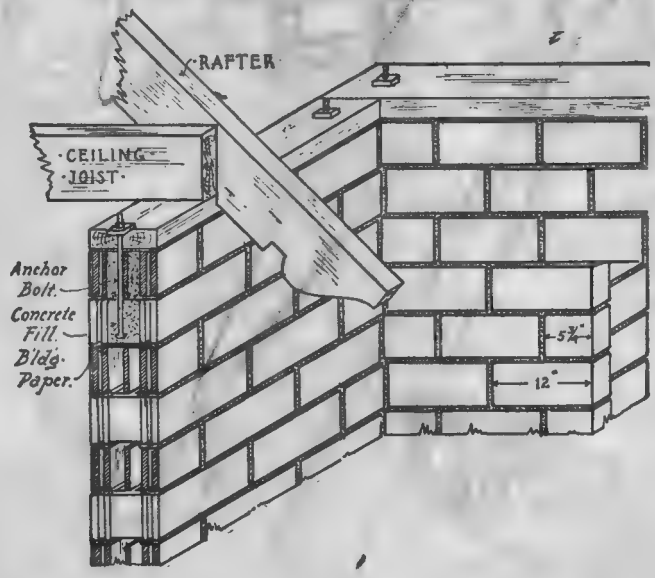


Fig. 1

Note method of bolting roof plate on top of tile wall. See also Figs. 3 and 4 for sectional views of above. Note also the reinforced tile and concrete lintel. The more popular type of lintel is the soldier lintel. (See Figs. 7, 8 and 10.) For plan of inside corner and windows jamb see Fig. 4.)

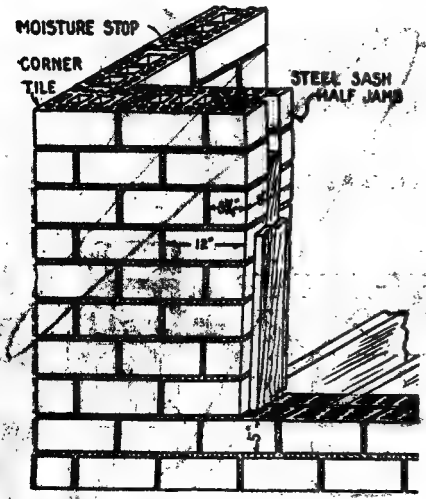


Fig. 2

Shows ordinary outside corner construction. Also shows method of making an absolutely weatherproof joint between tile and plank frame by using a strip of wood which has been nailed to the frame. This strip should fit into the recess in the tile. This method is recommended for all plank frames.

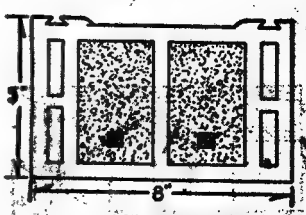


Fig. 3

Flat lintel showing reinforcing rods and concrete in both cells of tile. (See Fig. 1).

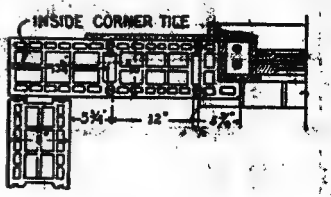


Fig. 4

Longitudinal cross section of wall shown in Fig. 1. Note jamb tile which provides space for sash weight box. Note the inside corner construction. This type of corner is required in ell shaped walls only

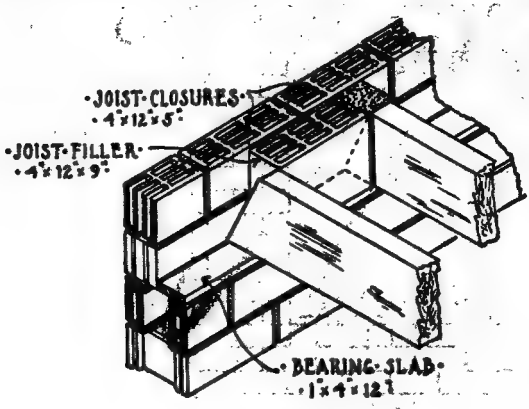


Fig. 5

Shows method of building wood joists in wall. Joist closure tile are used for exterior 4" of wall and by using 1" tile slabs bedded in mortar for the joists to rest on, the joists get a solid and flat bearing surface and the load is evenly distributed. The space between joists is filled with joist filler tile to make a solid wall to top of joists. Joists may be spaced as desired. Illustration shows joists 14" on centers.

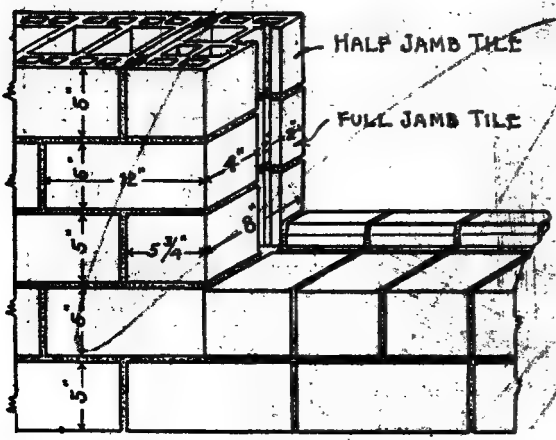


Fig. 6

Detail of opening for steel sash. Note recess in full and half steel sash jamb tile. (See Fig. 8 and 9 for method of bedding sash)

Fig. 7-A

Cross section through window showing how window frame fits at lintel and sill. For an absolutely weather proof job use roofers cement to seal between frame and tile.

Fig. 7

Window opening showing soldier lintel. Can also be reinforced with angle iron as shown in Fig. 10

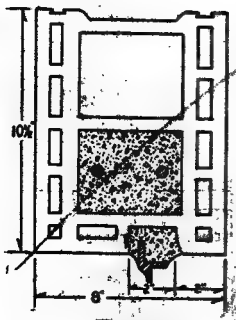
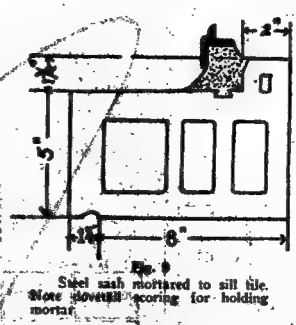


Fig. 8



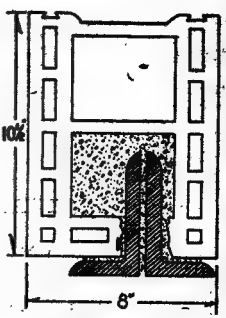


Fig. 10

Detail of lintel showing reinforced concrete beam in cell of tile and also method of bedding steel sash frame in the recess in steel sash lintel tile.

A method of reinforcing lintels over wide openings or where a heavy load bears above the openings. In order to allow the flanges of angles to go inside the tile, it is necessary to break out the small web of tile. This is very easily and safely done by tapping the web lightly with a hammer, breaking it out in small pieces until the web has been tapped out about half the length of the tile—then start at other end of tile and work to the middle.

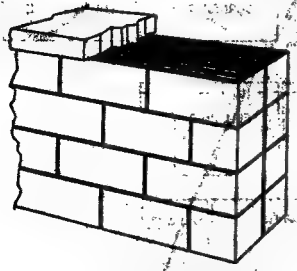


Fig. 11

Detail of porch balustrade built of joist closures laid back to back with staggered mortar joints. This gives a finished face on each side and on the end.

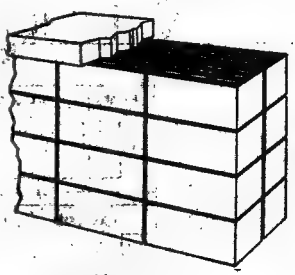


Fig. 12

Detail of porch balustrade built of joist closures back to back with mortar joints in line. This gives a finished face on each side and on the end.

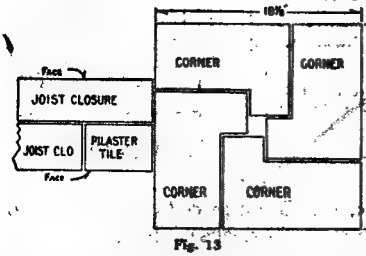


Fig. 13

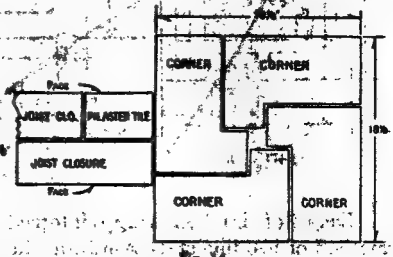


Fig. 14

PIERS

Figs. 13 and 14

Alternate course of a porch column and balustrade. This is the smallest column that can be built with finished faces on all four sides and true bonding of tile. Both sides of balustrade have finished faces. (See Figs 11 and 12)

Figs. 15 and 16

Details of alternate courses of a 24½" square column. Our engineering department will gladly furnish layouts of larger size columns on request

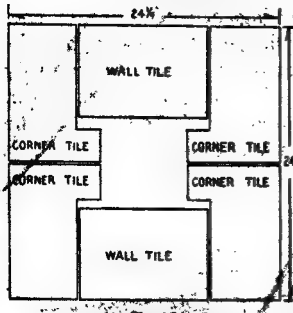


Fig. 15

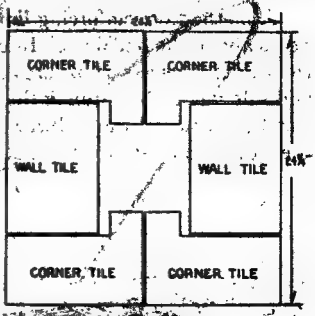
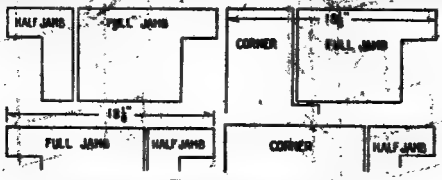


Fig. 16



Figs. 17 and 18

Alternate courses showing the minimum distance between two windows, and the minimum distance from corner of building to nearest window without cutting of tile

SUGGESTIONS FOR PILASTER CONSTRUCTION

The walls of industrial and commercial buildings are often designed to be built to considerable height without cross walls, and to bear heavy concentrated loads, such as floor beams and roof trusses. In these cases it is customary to build pilasters to stiffen the wall for wind pressure, and to carry these concentrated loads. Below are shown several pilaster layouts, and our engineering department will gladly furnish others if needed. Note that all pilasters are thoroughly bonded in the wall.

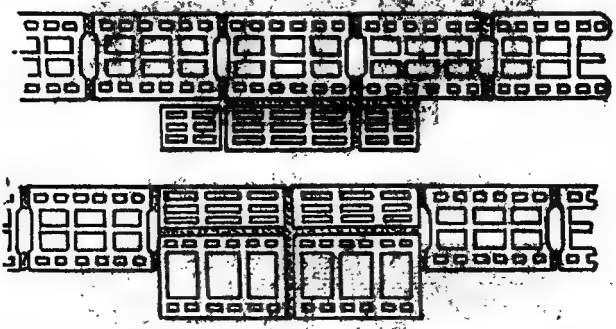


Fig. 22
Alternate courses of a pilaster 24½" wide with 4½" projection

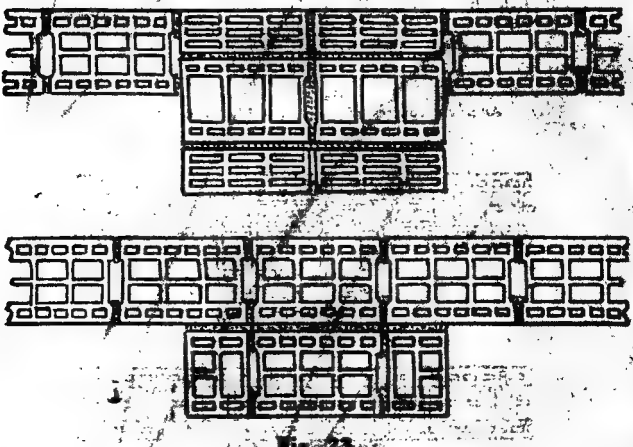


Fig. 23
Alternate courses of a pilaster 24½" wide with 8½" projection

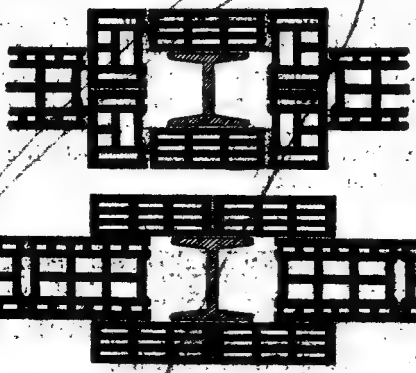


Fig. 24

Alternate courses showing method of enclosing H column. Gives a true bond. Our engineering department will gladly furnish layout for enclosing other sizes of columns

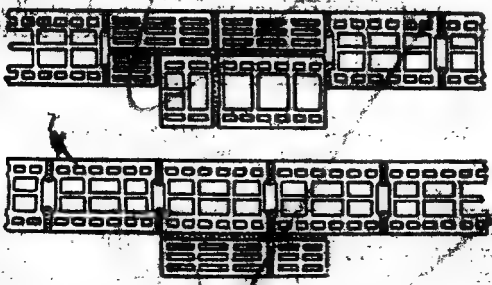


Fig. 25

Alternate courses of a pilaster 18½" wide with 4½" projection

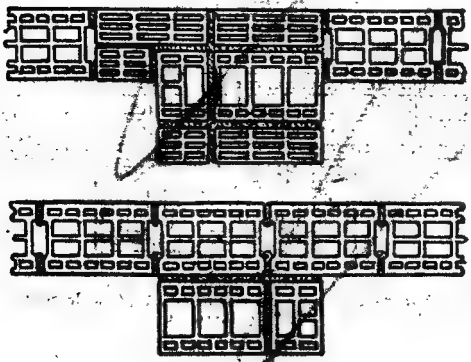
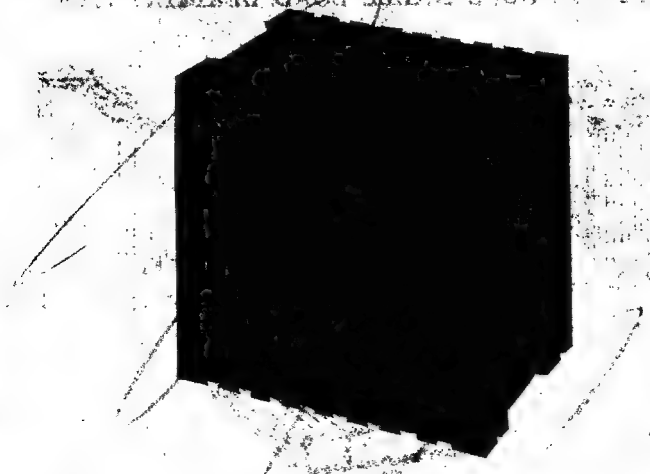


Fig. 26

Alternate courses of a pilaster 18½" wide with 8½" projection

Natco
Load Bearing
Tile



NATCO DOUBLE SHELL LOAD BEARING TILE
(For Stucco Walls)

General:

Natco Double Shell Load Bearing Tile is designed for vertical web load bearing walls to receive exterior stucco and interior plaster applied directly to the tile surfaces, or other exterior veneering, such as brick, stone, etc., where only the tile is figured to carry the load. The standard wall units have 12″x12″ dovetail scored faces and are furnished in four (4) thicknesses—6″, 8″, 10″, and 12″ to meet the various wall thickness requirements. Beside the standard wall unit's complete dovetail scored complementary accessory units are furnished in each thickness for sills, jambs (for both wood and steel windows), lintels, corners, joist closures, joist bearing slabs, joist fillers, etc. to obviate cutting and fitting.

With properly staggered joints all webs are brought into vertical alignment developing maximum wall strength.

Special Feature:

The outstanding feature of this tile is the double shell web construction on the two exposed faces which provides a wide, non-continuous, keyed mortar joint on both beds and ends. This non-continuous mortar joint not only permanently seals the outside face cell structure, materially increasing insulation, but most important, it positively prevents moisture passage by capillary attraction from the exterior to the interior.

Advantages:

Fireproof—Furnishes the maximum in permanent fire safety.

Low Labor Cost—The completeness of the line speeds erection by obviating the usual cutting and fitting.

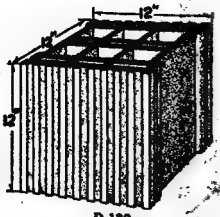
Maximum Insulation—The mortar sealed double shell exterior and interior ace construction adds materially to insulation, comfort and economy.

Permanent Stucco and Plaster Base—The dovetail scored tile surface provides the ideal stucco and plaster base.

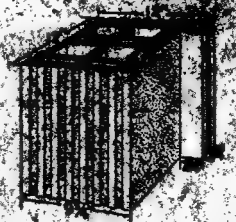
Prevents Interior Plaster Stains—The non-continuous mortar joints prevent discoloration on the interior.

Ideal for Pipe Installation—The vertical voids furnish provision for pipe chases for conduit and other piping easily accomplished without shattering the tile and with the minimum patching.

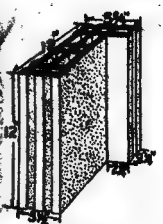
NATCO DOUBLE SHELL LOAD BEARING TILE



D-120
12" x 12" x 12" Double Shell Wall Tile

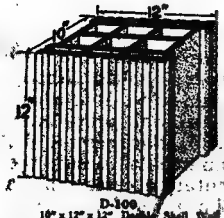


D-122
12" x 12" x 12" Double Shell Jamb for Box Frame Windows. (See Fig. 7)

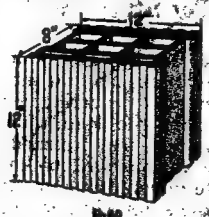


D-124
12" x 5⅝" x 12" Double Shell Half Jamb for Box Frame Windows. (See Fig. 7)

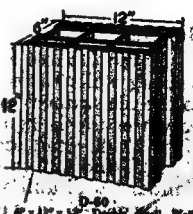
X-1127
14" x 5⅝" x 12" Sill for 12" Wall. (See Fig. 10)



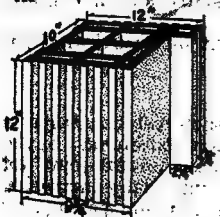
D-100
10" x 12" x 12" Double Shell Wall Tile



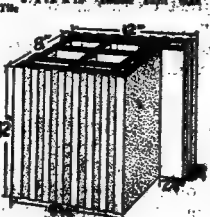
D-80
8" x 12" x 12" Double Shell Wall Tile



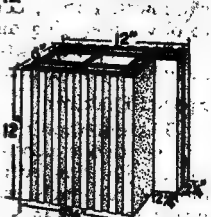
D-60
6" x 12" x 12" Double Shell Wall Tile



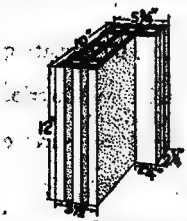
D-102
10" x 12" x 12" Double Shell Jamb for Box Frame Windows. (See Fig. 7)



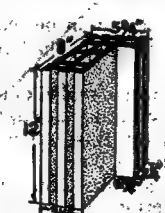
D-82
8" x 12" x 12" Double Shell Jamb for Box Frame Windows. (See Fig. 7)



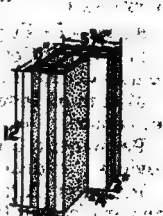
D-62
6" x 12" x 12" Double Shell Wall Jamb for Box Frame Windows. (See Fig. 7)



D-104
10" x 5⅝" x 12" Double Shell Half Jamb for Box Frame Windows. (See Fig. 7)

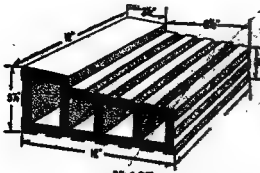


D-84
8" x 5⅝" x 12" Double Shell Half Jamb for Box Frame Windows. (See Fig. 7)

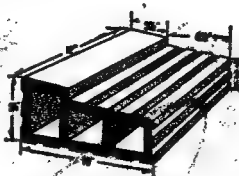


D-64
6" x 5⅝" x 12" Double Shell Half Jamb for Box Frame Windows. (See Fig. 7)

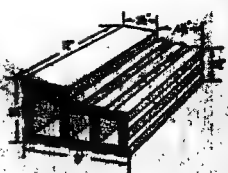
NATCO DOUBLE SHELL LOAD BEARING TILE



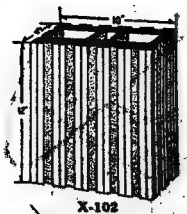
X-107
12" x 5¼" x 12" Sill for 10" Wall. (See Fig. 10)



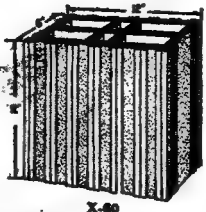
X-87
10" x 5¼" x 12" Sill for 8" Wall. (See Fig. 10)



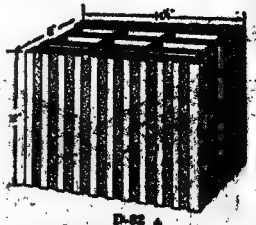
X-97
8" x 5¼" x 12" Sill for 6" Wall. (See Fig. 10)



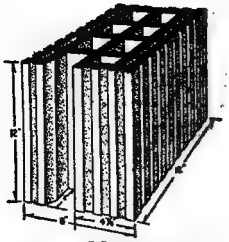
X-102
10 x 4" x 12" Corner for 10" wall. (See Fig. 5)



X-80
8" x 12" x 12" for 6" and 12" Walls. (See Figs. 3 and 6)



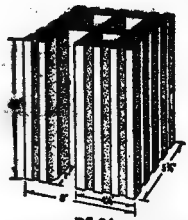
D-82
8" x 14¾" x 12" Double Shell Corner for 8" Wall. (See Fig. 4)



DS-83
8" x 12" x 12" Full Jamb or Lintel Tile for Steel Sash and Plank Frame Windows and Doors. Recess in tile takes care of flange on steel sash or wood weather strip on plank frame. This tile is also used as a Full Closure Tile

4" x 1" x 12" } 6" x 1" x 12" } **Slabs** { 8" x 1" x 12" 12" x 1" x 12"

X-40
8¾" x 12" x 12" Joint Closure also cut 10½" high for use as Joint Filler. (See Fig. 1)



DS-84
8" x 1⅝" x 12" Half Jamb for Steel Sash and Plank Frame Windows and Doors. Recess in tile takes care of flange on steel sash or wood weather strip on plank frame. This tile also used as a Half Closure Tile

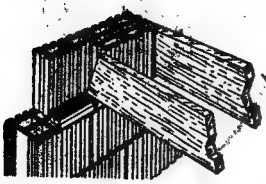


Fig. 1

Fig. 1
Shows method of building wood plate into wall. 4⅜" x 12" x 12" tile are used for the interior face of wall and by using 1" slab slabs for the joists to rest on, they get a solid and flat bearing surface and the load is evenly distributed. The space between joists is filled with 3⅜" x 12" x 10½" filler tile to make a solid wall to top of joists. Joists may be spaced as desired. Illustration shows joists 16" on centers

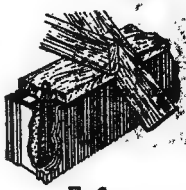


Fig. 2

Fig. 2
Bolting of roof plate to top of wall is necessary in any masonry wall to anchor roof and prevent its dislodgement due to high wind pressure.

NATCO DOUBLE SHELL LOAD BEARING TILE

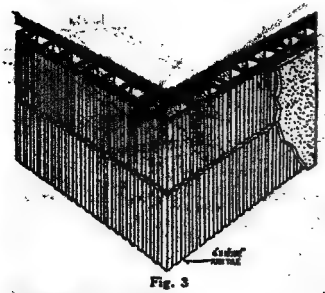


Fig. 3

Fig. 3
Corner construction in a 8" Double Shell Load Bearing Wall

Fig. 4
Corner construction in an 8" Double Shell Load Bearing Wall

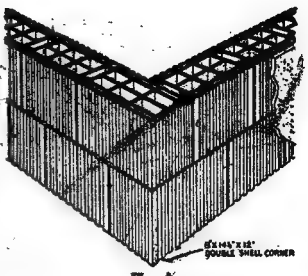


Fig. 4

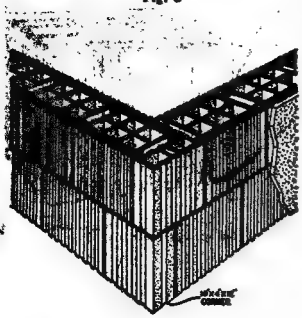


Fig. 5
Corner construction in a 10" Double Shell Load Bearing Wall

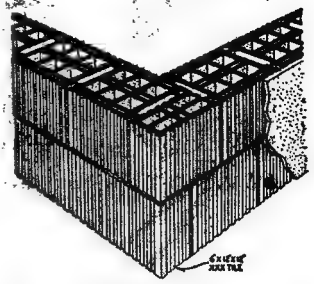


Fig. 6
Corner construction in a 12" Double Shell Load Bearing Wall

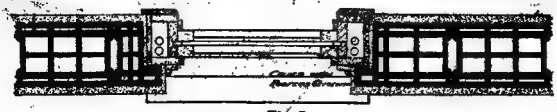


Fig. 7
Longitudinal cross section showing use of full and half jamb tile with box frame. Recess in tile provides space for sash weight box

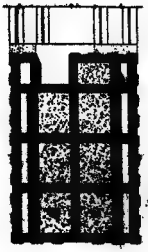


Fig. 8
Reinforced lintel made by placing steel rods in bottom cells of steel sash full jamb and filling cells of tile with concrete. For use with steel sash, reverse tile and construct as above

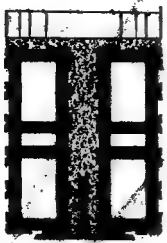


Fig. 9
Lintel construction over wide openings, using 3½"x12"x12" tile for wall finishes and steel angles for carrying load

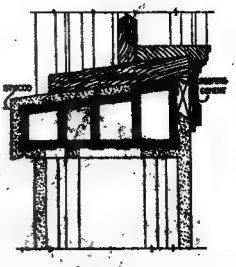
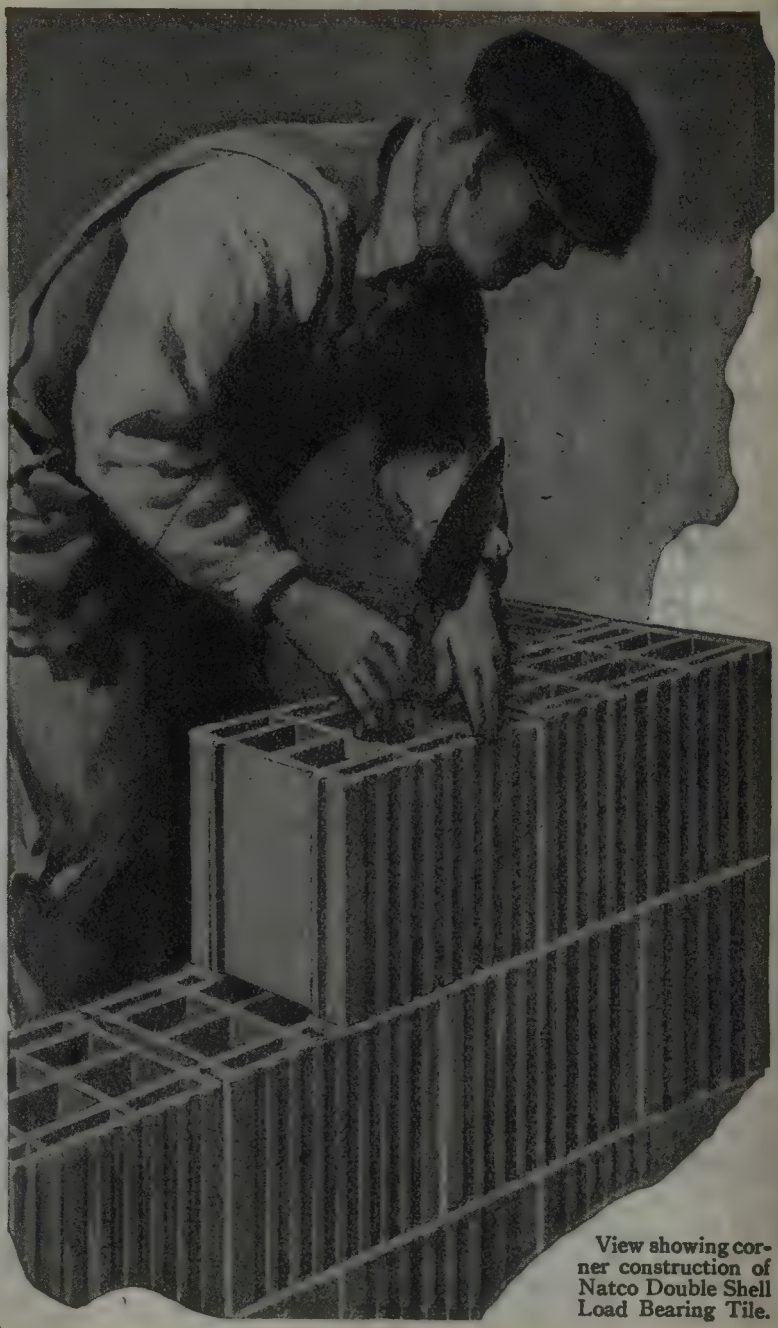


Fig. 10
Section at window sill showing fitting of frame to sill and waterproofing between frame and sill with roofers' cement

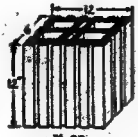


View showing corner construction of Natco Double Shell Load Bearing Tile.

NATCO XXX LOAD BEARING TILE

Standard Wall Tile

X-40
1⅛"x12"x12" XXX Wall Tile

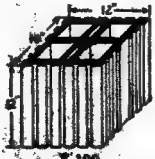


X-60
6"x12"x12" XXX Wall Tile

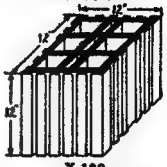
X-82
8"x3"x12" Corner for 8" wall

X-102
10"x4"x12" Corner for 10" wall.
See Fig. 5, page 27

X-80
8"x12"x12" XXX Wall Tile



X-100
10"x12"x12" XXX Wall Tile

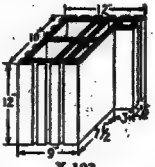


X-120
12"x12"x12" XXX Wall Tile

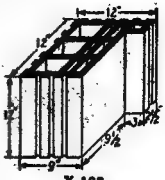
Full and Half Jamb Tile

X-63
6"x12"x12" XXX Full Jamb for Box Frame Windows

X-83
8"x12"x12" XXX Full Jamb for Box Frame Windows



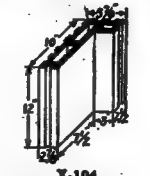
X-103
10"x12"x12" XXX Full Jamb for Box Frame Windows



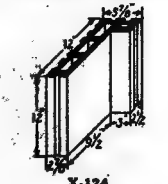
X-123
12"x12"x12" XXX Full Jamb for Box Frame Windows

X-64
6"x5⅝"x12" XXX Half Jamb for Box Frame Windows

X-84
8"x5⅝"x12" XXX Half Jamb for Box Frame Windows

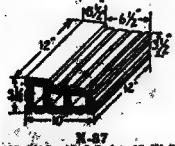


X-104
10"x5⅝"x12" XXX Half Jamb for Box Frame Windows



X-124
12"x5⅝"x12" XXX Half Jamb for Box Frame Windows

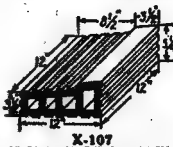
Sills



X-87
10"x5⅛"x12" Sill for 8" Walls

X-127
14"x5⅛"x12" Sill for 12" Walls.

X-67
6"x5⅛"x12" Sill for 6" Walls



X-107
12"x5⅛"x12" Sill for 10" Wall

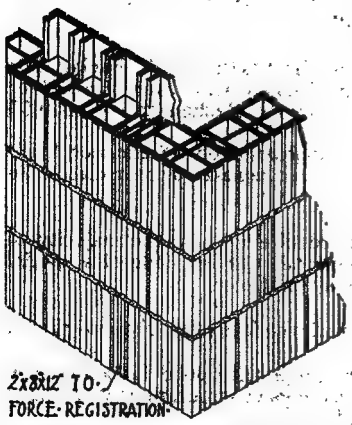
Slabs

Eastern Plants	Central and Western Plants	
6"x1"x12"	4"x1"x12"	10"x1"x12"
8"x1"x10"	6"x1"x12"	12"x1"x12"
8"x1"x12"	8"x1"x12"	

NATCO XXX LOAD BEARING TILE

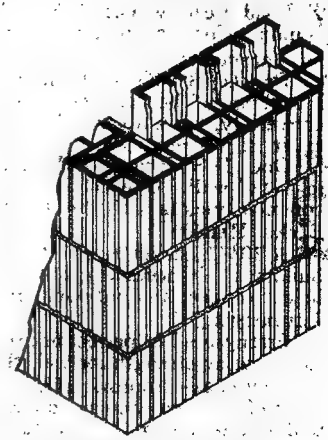
Natco XXX Load Bearing Tile is furnished for construction similar to that of Natco Double Shell Load Bearing Tile, where a lighter weight tile is required. It is extensively used in the eastern tile market.

Full and Half Jamb Tile, as illustrated below, are manufactured at our Eastern Plants only. For illustrations and description of Full and Half Jamb Tile as shipped from our Central and Western Plants, see details under Natco Double Shell Load Bearing Tile on preceding pages.

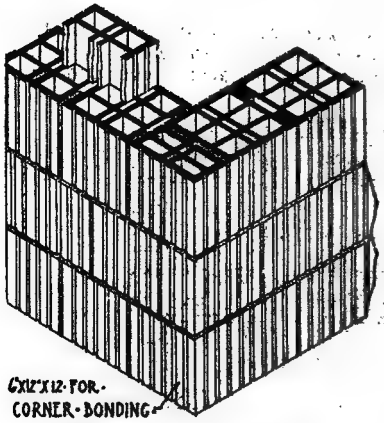


2x8x12" TO FORCE REGISTRATION

ISOMETRIC VIEW OF 8 INCH TILE WALL

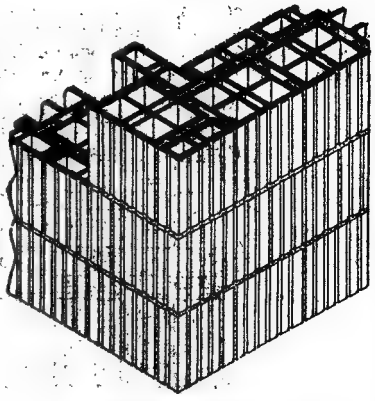


ISOMETRIC VIEW OF 10" TILE WALL



6x12x12 FOR CORNER BONDING

ISOMETRIC VIEW OF 12" TILE WALL



ISOMETRIC VIEW OF 14" TILE WALL

NATCO HEADER BACKER

General:

Natco Header Backer Tile is particularly well adapted for exterior load bearing walls faced with brick since the perfect bond every sixth (6th) course between brick and tile allows the full thickness of the masonry wall to be calculated for load carrying capacity. It is the only tile giving a 10″ wall with an all tile backing. The 10″ and 14″ thicknesses are not obtainable in solid brick masonry.

Western Header Backer:

The Western Header Backer is designed structurally similar to the Double Shell Load Bearing Tile and has all its advantages. (See Page 212.)

Eastern Header Backer:

The Eastern Header Backer is designed structurally similar to the Triple X Load Bearing Tile. The 1″ shell and web thickness fulfill New York Building Code requirements. (See Page 210.)

Displacement:

One (1) 8″x5″x12″ Header Tile and one (1) 8″x12″x10½″ Backer Tile including ½″ bed and vertical joints lay up 1.43 sq. ft. of wall surface; or conversely, there are required 700 Headers and 700 Backers to lay up 1000 sq. ft. of wall surface.

One (1) 8″ Header and Backer replaces approximately 18 common brick in a 12″ wall. One (1) 12″ Header and Backer replaces approximately 28 common brick in a 16″ brick faced wall.

Backer Height:

A 10½″ backer is standard and fulfills requirements in the majority of buildings. If necessary, however, the backer tile can be made of a special height to meet any ordinary brick and mortar joint condition.

Advantages:

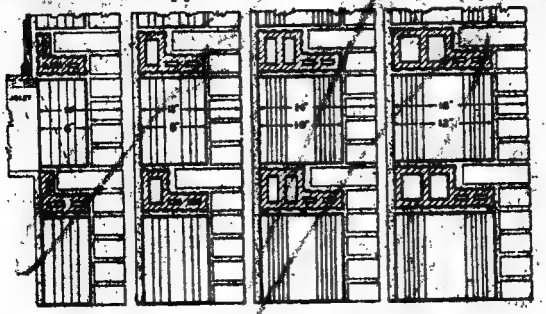
Strength—The perfect 6th course bond with the face brick gives maximum load bearing strength for wall thickness.

Lightness—Approximately 25 per cent lighter than solid brick masonry walls of equal thickness and result in great savings in structural steel tonnage and foundation costs are materially reduced.

Insulation—The cellular tile structure promotes insulation comfort and economy.

Adaptability:

The strong, light Natco Header Backer construction is particularly adapted to use in all brick faced buildings, whether of load bearing or curtain closure wall construction, where the maximum in good construction and economy in labor costs are appreciated.



10″ Wall 12″ Wall 14″ Wall 16″ Wall

Typical Wall Sections

The standard backer is 10½″ high. While these sections show walls, including brick facing, 10, 12, 14 and 16″ only, thicker walls may easily be obtained by using additional tile

NATCO HEADER BACKER TABLES FOR STANDARD HEIGHT TILE.

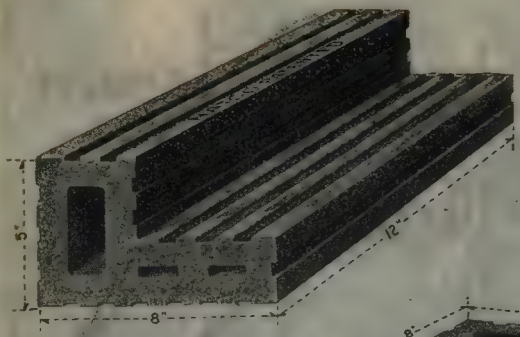
For 10″ Walls use 6″ Thickness tile with 3¾″ Brick
12″ Walls use 8″ Thickness tile with 3¾″ Brick
14″ Walls use 10″ Thickness tile with 3¾″ Brick
16″ Walls use 12″ Thickness tile with 3¾″ Brick

FOR TILE FROM EASTERN FACTORIES.

Header Course	Brick and Joint	Height of Brick Facing	Height of Tile Backer	Tile Joint		1 Header 1 Backer Lays up	Required to lay up 1000 sq. ft.	
				Vertical	Horizontal		No. Headers	No. Backers
5th	3″	15″	9¼″	½″	½″	1.30	770	770
6th	2½″	15″	9¼″	½″	½″	1.30	770	770
6th	2⅝″	15¾″	10″	½″	½″	1.36	740	740
6th	2¾″	16½″	10½″	½″	½″	1.43	700	700
6th	2⅞″	17¼″	11¼″	½″	½″	1.49	670	670
7th	2½″	17½″	11¼″	½″	½″	1.52	655	655
7th	2⅝″	18⅜″	12″	½″	⅜″	1.59	630	630

FOR TILE FROM OHIO FACTORIES

5th	3″	15″	9¼″	½″	⅜″	1.30	770	770
6th	2½″	15″	9¼″	½″	⅜″	1.30	770	770
6th	2⅝″	15¾″	10″	½″	⅜″	1.36	740	740
6th	2¾″	16½″	10¾″	½″	⅜″	1.43	700	700
6th	2⅞″	17¼″	11½″	½″	⅜″	1.49	670	670
7th	2½″	17½″	12″	½″	¼″	1.52	655	655
7th	2⅝″	18⅜″	12¾″	½″	5/16″	1.59	630	630

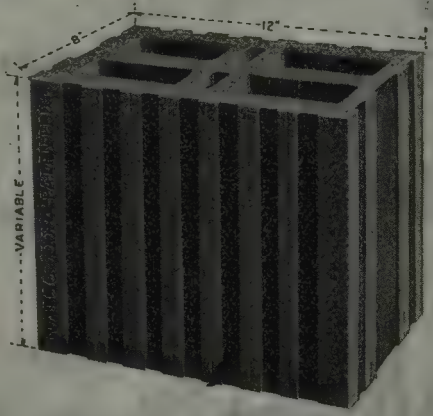


EASTERN NATCO HEADER TILE (Patented)

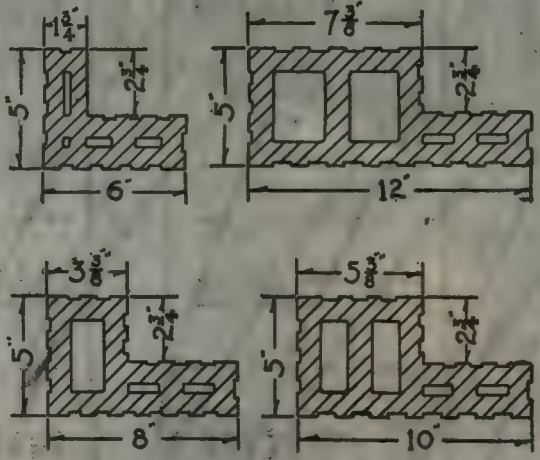
Forms a perfect bond between facing material and tile backing.

Height of backer can be varied to meet different mortar joint and bonding conditions.

For districts outside of New York City a Natco Header Backer Tile with webs and shells lighter than the regular Eastern Header Backer Tile is furnished.



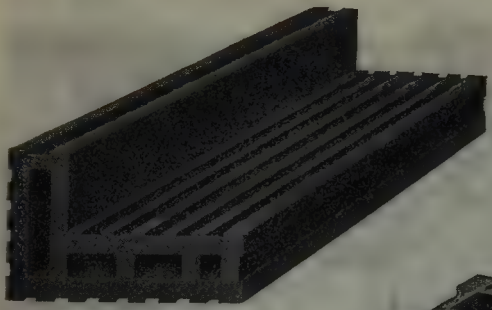
EASTERN NATCO XXX BACKER TILE (Patented)



Eastern Header

The web design matches that of the Eastern backer tile with 1" web thickness for the New York City market

Laying Natco Header Backer Tile with covering for exterior wall column. (Eastern Type).



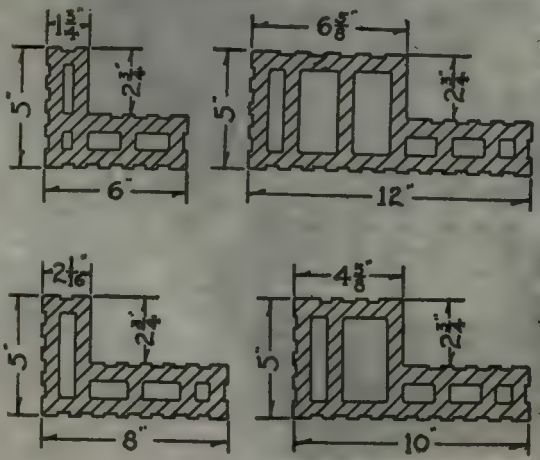
NATCO
HEADER TILE
(Patented)
(Western)

Height of backer can be varied to meet different mortar joint and bonding conditions.

NATCO
DOUBLE SHELL
BACKER TILE
(Patented)
(Western)

Natco Header Backer Tile

8 x 12 x 10½" (Western)



Western Header
The web design matches that of the double shell Western backer tile

PARTIAL LIST OF NATCO HEADER BACKER JOBS

WASHINGTON TERRITORY

Name of Building	Location
Cavalier Hotel	Virginia Beach, Va.
Chesapeake & Potomac Telephone Company	Washington, D. C.
Hampton High School	Hampton, Va.
Physiology Building, Johns Hopkins University	Baltimore, Md.
Seaboard Air Line Building	Norfolk, Va.
Club Apartments	Baltimore, Md.
Woodmont School & Barcroft School	Arlington County, Va.
Washington and Lee High School	Arlington County, Va.

NEW YORK TERRITORY

N. Y. Athletic Club	New York City
Chrysler Building	New York City
Addition to Hotel St. George	Brooklyn, N. Y.
Bank of Manhattan Building	New York City
Chase National Bank	New York City
Apartment and Hotel Group	New York City
Barclay-Vesey Telephone Building	New York City
Savoy-Plaza Hotel	New York City
Sherry-Netherland Apartment Hotel	New York City
Ritz Tower	New York City
Group of Medical Centre Buildings	New York City
Kresge Department Store	Newark, N. J.
Public Service Terminal Building	Newark, N. J.
Convention Hall	Asbury Park, N. J.
Barracks Building at Fort Wadsworth	St. George, S. I., N. Y.
Presbyterian Church	Hackensack, N. J.
Governor Clinton Hotel	Kingston, N. Y.
Second Presbyterian Church	Newark, N. J.

PHILADELPHIA TERRITORY

Nurses' Home	Camden, N. J.
Hospital	Wilmington, Dela.
Cooper Hospital Addition	Camden, N. J.
Nurses' Home	Philadelphia, Pa.
Colony Hospital	Vineland, N. J.
Pennsylvania Hospital	Philadelphia, Pa.
Theatre	Newark, Dela.
Theatre	Philadelphia, Pa.
Theatre	Lehighton, Pa.
Apartment	Philadelphia, Pa.
Apartment	Cynwyd, Pa.
Apartment	Hazelton, Pa.
Apartment	Philadelphia, Pa.
Apartment and Store	Shenandoah, Pa.
Residence	York, Pa.
Y. M. C. A. Building	Philadelphia, Pa.
Y. W. C. A. Building	Atlantic City, N. J.
Residence	Wilmington, Dela.
Residence	York, Pa.
Residence	York, Pa.
Residence	Mt. Carmel, Pa.
Eagles Lodge	Lewistown, Pa.
Cottage	Vineland, N. J.
Residence and Garage	Greenfield, Pa.
Masonic Temple	Atlantic City, N. J.

Cottage	Pleasantville, N. J.
Club, B. P. O. E.	Philadelphia, Pa.
F. O. O. E. Club	Williamsport, Pa.
St. Michaels R. C. Church	Northampton
Chapel and Convent	Scranton, Pa.
Library	Bethlehem, Pa.
Library	Newark, Dela.
Power House	Atlantic City, N. J.
Publishing Plant	Easton, Pa.
Firehouse and Hall	Bridgeport, Pa.
Community Building	Philadelphia, Pa.
Synagogue	Hazelton, Pa.
Synagogue	Philadelphia, Pa.
Warehouse	Philadelphia, Pa.
Telephone Building	Lewistown, Pa.
Telephone Building	York, Pa.
Seventeen Elementary and High Schools	Philadelphia, Pa.
School	Fallsington, Pa.
School	Andalusia, Pa.
School	Bridgeport, Pa.
School	Southampton, Pa.
School	Summitt Hill, Pa.
School	Horsham, Pa.
State Forestry School	Mont Alto, Pa.
School	Willow Grove, Pa.
School	Roslyn, Pa.
School	Weatherly, Pa.
School	Sheppton, Pa.
School	Lansford, Pa.
School	Avon, Pa.
School	Moores, Pa.
School	Reading, Pa.
School	Reading, Pa.
School	Harrington, Dela.
School	Milford, Dela.
School	Felton, Dela.
School	Seaford, Dela.
School	Millsboro, Dela.
School	Dover, Dela.
School	Wilmington, Dela.
School	Shiloh, N. J.
School	Alloway, N. J.
School	Bridgeton, N. J.
School	Pensauken, N. J.
School	Aura, N. J.
School	Woodbine, N. J.
School	Bridgeton, N. J.
School	Roebling, N. J.
Hotel	Lancaster, Pa.
Brigantine Hotel	Brigantine Beach, N. J.
Hotel and Restaurant	Philadelphia, Pa.
Office Building	York, Pa.
Office Building	Philadelphia, Pa.
Metropolitan Edison Office Building	Reading, Pa.
Office Building	Allentown, Pa.
Office Building	Philadelphia, Pa.
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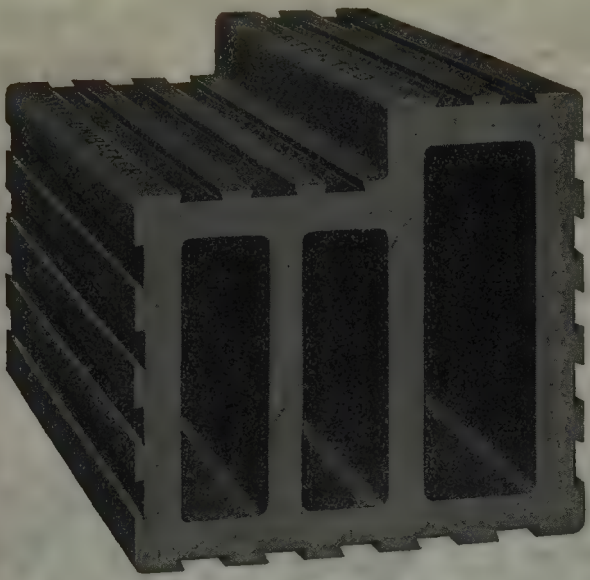
Office Building	Philadelphia, Pa.
Office Building	Philadelphia, Pa.
Office Building	Philadelphia, Pa.
Office Building	Philadelphia, Pa.
Mitten Office Building	Philadelphia, Pa.
Book Store	Philadelphia Pa.
Deptartment Store	Lansford, Pa.
Bank	Lancaster, Pa.
Bank	Newtown, Pa.
Bank and Office	Port Royal, Pa.
Bank	Kingston, Pa.
Bank	Old Forge, Pa.
Bank	Ocean City, N. J.
Bank and Office	Harrisburg, Pa.
Bank	Hazelton, Pa.
Bank and Office	Pottsville, Pa.
Bank	Selleysville, Pa.
Bank	Mahanoy City, Pa.
Bank	Manheim, Pa.

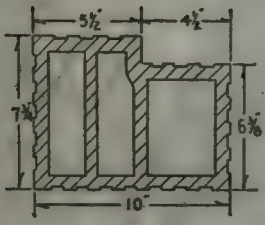
PITTSBURGH TERRITORY

St. Mary's Hospital	Huntington, W. Va.
Telephone Building	Wilkinsburg, Pa.
Riker Office Building	Pontiac, Mich.
Fordson School	Fordson, Mich.
Grant Building	Pittsburgh, Pa.
American Rolling Mill	Middletown, Ohio
Wilmer Eye Clinic, St. Johns Hospital	Baltimore, Md.
Grade School	Herndon, Va.
McKees Rocks High School	McKees Rocks, Pa.
Clark Building	Pittsburgh, Pa.
Professional Building	Pittsburgh, Pa.
Magee Hospital Addition	Pittsburgh, Pa.
Butler Telephone Building	Butler, Pa.
Veteran's Hospital Building	Aspinwall, Pa.
Bellevue M. E. Church Addition	Bellevue, Pa.
Odd Fellows Orphanage	N. S., Pittsburgh, Pa.
Leetsdale High School	Leetsdale, Pa.
Penn-Beaver Hotel	Rochester, Pa.
Seville School	N. S., Pittsburgh, Pa.
St. John's Hospital Nurses' Home	N. S., Pittsburgh, Pa.
St. Joseph's Parochial School	Pittsburgh, Pa.
St. Philomena Church	Pittsburgh, Pa.
Sewickley High School	Sewickley, Pa.
Sherodd Temple	Pittsburgh, Pa.
Springdale Grade School	Springdale, Pa.
West Homestead School	Homestead, Pa.
North Side Y. M. C. A.	N. S., Pittsburgh, Pa.



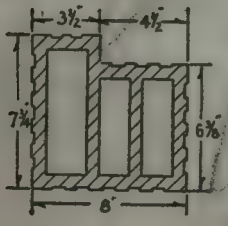
NATCO UNIBACKER

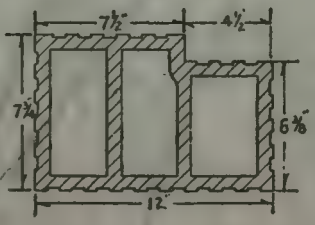
(Western)



Western Unibacker

As manufactured at our Ohio and Western plants.





NATCO UNIBACKER

General:

Natco Unibacker is a load bearing unit used in brick faced load bearing or curtain closure walls. It provides a mechanical bond every sixth (6th) course of such strength that full bearing value is allowed on the full masonry wall thickness.

Natco Unibacker can be bonded satisfactorily with Column Covering as three courses of the Unibacker will bond into two courses of the Column Covering.

The Eastern Unibacker is designed with 1" thick shell and webs particularly for the New York market.

Full bearing is provided for floor joists in load bearing walls.

The standard tile is dovetail scored for interior plaster.

Smooth Face Tile:

If unplastered smooth tile walls are desired, unscored tile can be manufactured on special order. Adequate notice must obviously be given through our nearest branch office.

Economy of the Single Unit:

Unibacker is made in a single tile shape and size which permits great speed of erection and consequent labor economies. This is particularly apparent in long curtain walls without openings.

Its weight, compared with solid brick masonry, materially reduces foundation and steel costs without sacrifice of strength and permanence.

Unibacker is particularly economical of mortar. It saves approximately one-third (⅓) over ordinary tile construction.

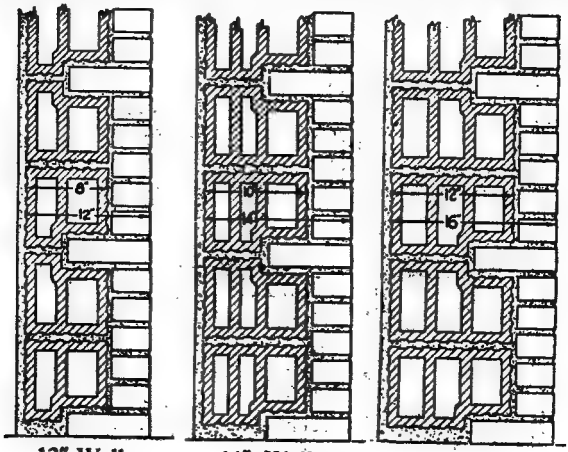
Displacement:

Each Unibacker unit replaces (according to thickness) from 8 to 12 brick, which accounts for the pronounced savings in erection costs and the greater erection speed.

The inner face is 12"x7¾". Standard thicknesses are 8, 10 and 12" for 12, 14 and 16" walls. Each tile lays up .715 sq. ft. of wall surface when ½" mortar joints are used. 140 units lay up 100 sq. ft. of wall.

Adaptability:

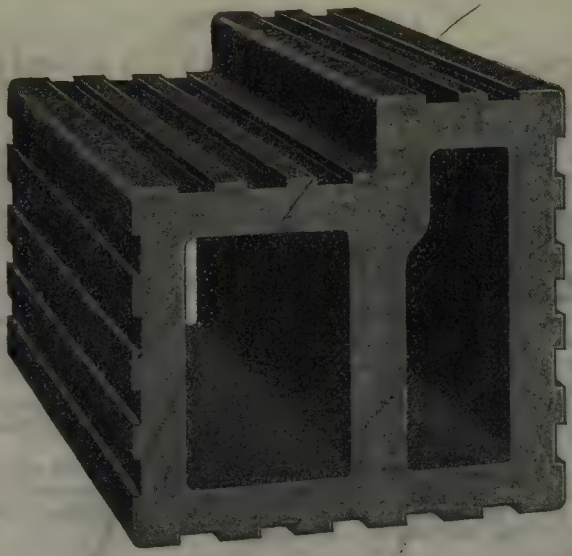
A strong, light construction with speed and labor economies adapting it admirably to use in all types of brick faced buildings of either load bearing or skeleton curtain wall construction also available with vertical cells.



12" Wall 14" Wall 16" Wall

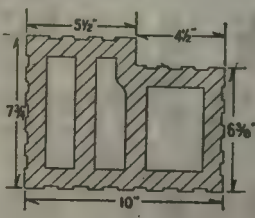
Typical Wall Sections

While these sections show walls including brick facing, 12, 14 and 16" only, thicker walls may easily be obtained by using additional tile

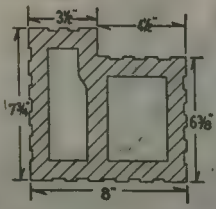


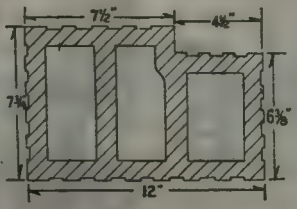
NATCO UNIBACKER

(*Eastern*)



Eastern Unibacker
This tile is particularly designed for the New York market where 1" thick shell and webs are required





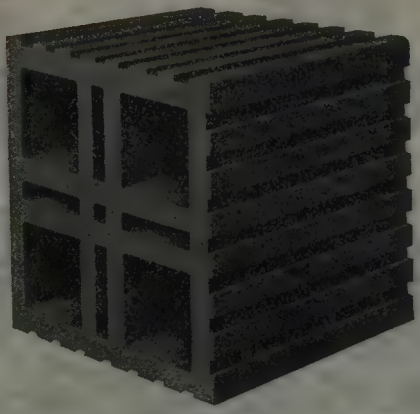
Eastern factories also manufacture Unibacker Tile with ¾" webs and shells. The 8" size can also be furnished in 7⅛" and 7⅝" heights.

Laying Natco Unibacker and Exterior Column Covering in a New York Building

(*Note Heavy Webs and Shells*)

NATCO HEATH CUBES

7¾" x 7¾" x 7¾"



Natco Heath Cubes are standardized hollow structural clay tile units, cubical in shape, dimensioned according to the established measurement of brick work. Their size, 7¾"x7¾"x7¾", exactly that of six brick, permit the substitution of Natco Cubes wherever brick has been figured.

Standard Natco Cubes have one smooth face and three scored faces. They can also be made with four scored faces. The Standard Half Cube has one face and one end smooth. The Standard Header Cube is scored four sides but on special order the inside face can be made smooth.

With Natco Cubes, it is possible to build an all-tile wall, regardless of the number of openings, piers, pilasters, chases or corners.

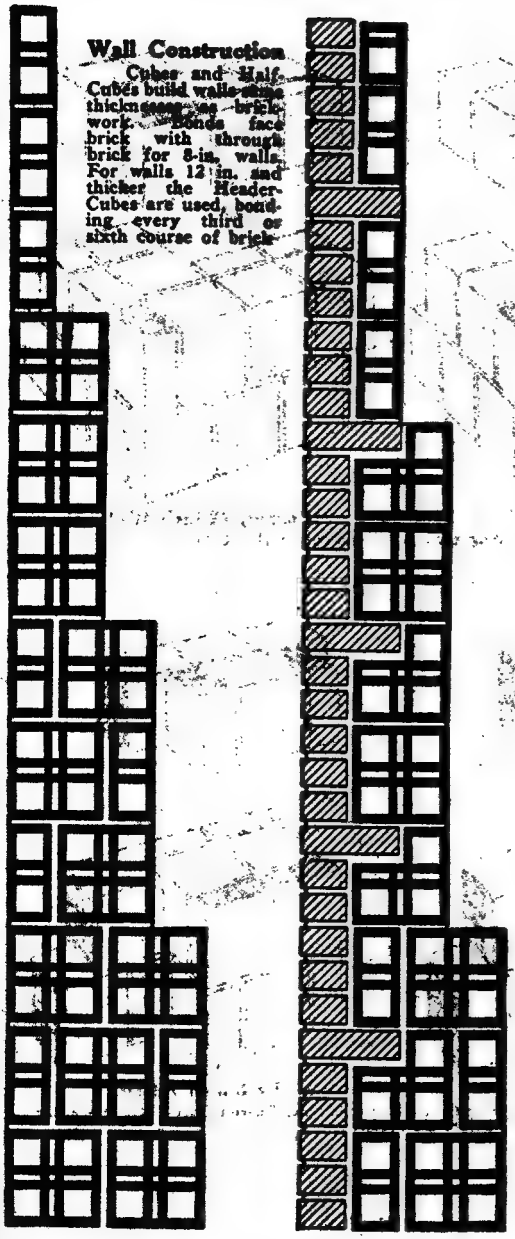
Natco Cubes are furnished in either whole or fractional units. Ordering a sufficient number of Header Cubes will save time and possible waste on the job. Since two Half Cubes can be set in place of one whole cube, it is advisable to make your estimate on this shape generally. Quarter Cubes can be split from Half Cubes as needed. In any case, the whole cube is always divisible into any shape on the job.

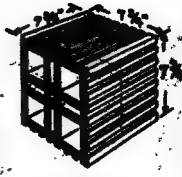
Estimating Data

2 Half-Cubes build 1 sq. ft. of 4-in. wall.
2 Cubes build 1 sq. ft. of 8-in wall.
2 Cubes and 2 halves build 1 sq. ft. of 12-in. wall.
3 Cubes and 2 halves build 1 sq. ft. of 16-in. wall.
4 Cubes and 2 halves build 1 sq. ft. of 20-in. wall.
3 Cubes equal 1 cu. ft., including mortar.
1 Cube equals 6 brick, including mortar.
167 Cubes equal 1000 brick in the wall.
1000 Cubes require 1 yd. of mortar.
120 lb. per sq. in. gross area, is the safe working load for either side-set or end-set construction.
Webs and shells are ⅝ in. thick. Cube contains 52% solids and 48% voids.
One cubic foot of Heath Cube masonry weighs 60 lb.
Cubes are generally scored but they may be obtained smooth on as many faces as desired.

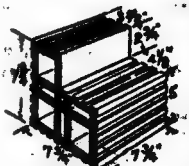
Wall Construction

Cubes and Half-Cubes build walls same thickness as brick-work. Bonds face brick with through brick for 8-in. walls. For walls 12 in. and thicker the Header-Cubes are used, bonding every third or sixth course of brick.





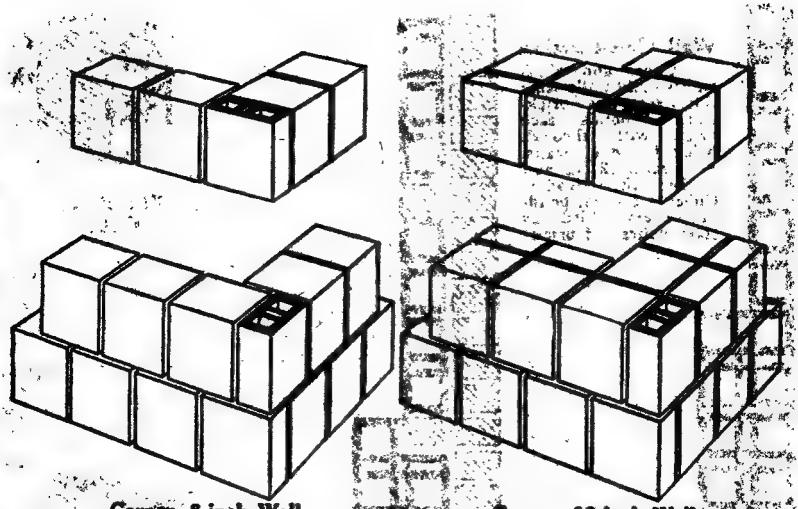
The Basic Cube



Header-Cube

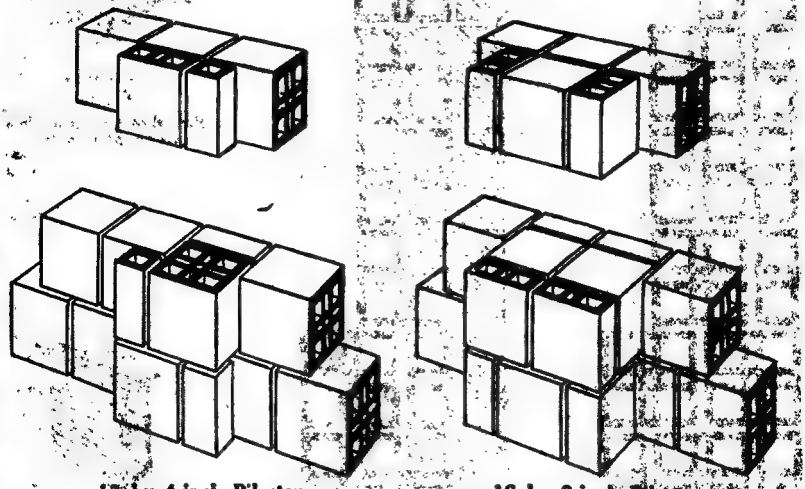
Furnished smooth inside face on special order

Half-Cube



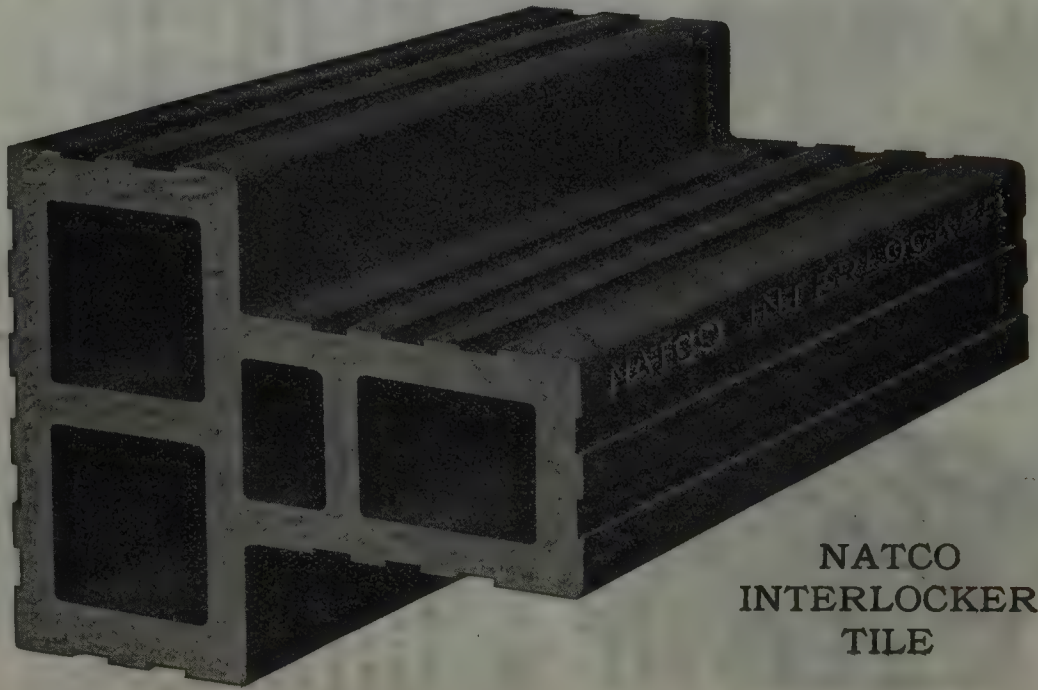
Corner, 8-inch Wall — Corner, 12-inch Wall

Method of building corners by end-setting Half-Cubes



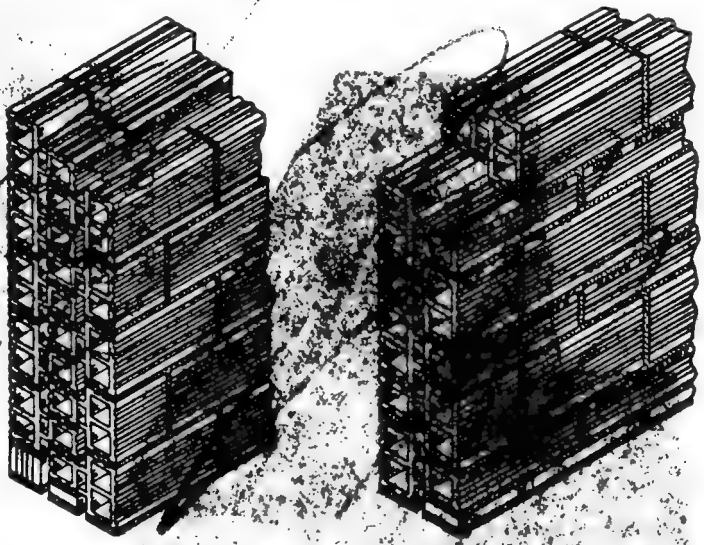
12 by 4-inch Pilaster — 16 by 8-inch Pilaster

Method of building pilasters by end-setting Cubes, Half-Cubes and Quarter-Cubes. No special tile shapes are required



NATCO
INTERLOCKER
TILE

NATCO INTERLOCKER TILE



Twelve Inch Tile Wall. Note starting slab used in first course for starting.

Eight Inch Tile Wall. Note starting slab used in first course.

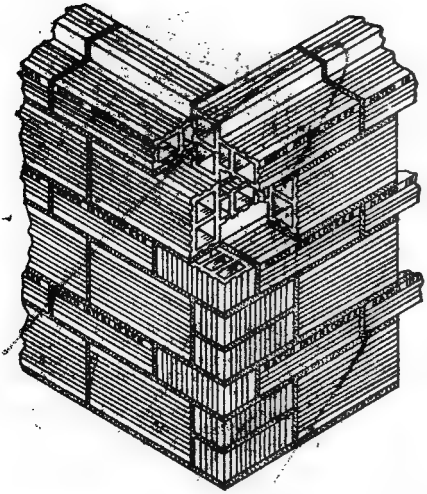
Natco Interlocker Tile is used for load bearing and closure walls, either in combination with brick or stucco, or without facing.

The units are light enough to be handled with one hand—are laid quickly and easily—effect a considerable saving in mortar and labor cost.

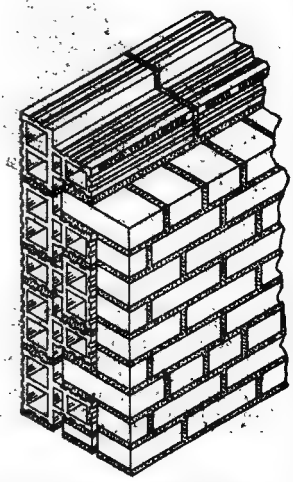
Mechanically bonded Interlocker walls may be built to any thickness desired. The vertical webs are always aligned, assuring maximum strength. Dead air spaces bar heat and cold, and the non-continuous mortar joints prevent the passage of moisture. Plaster is applied directly to the interior surface without furring.

Natco Interlocker provides economical, fire-proof, strong, permanent construction.

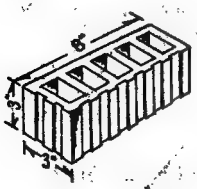
NATCO INTERLOCKER TILE



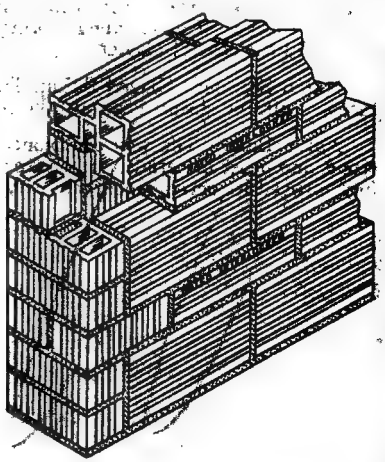
Method of corner construction on eight inch walls.



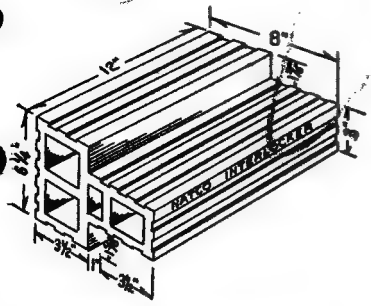
Twelve inch combination wall (eight inch tile, four inch brick.)



Dimensions of closure block. One face and one end are scored—other face and end smooth.



Closing eight inch wall end. Note mechanical bond of closure block with interlocker.

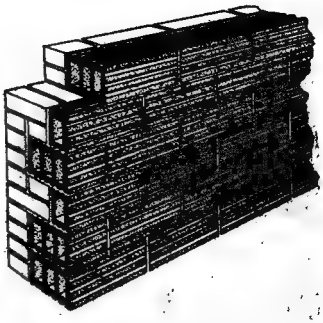


Dimensions of Natco Interlocker.

NATCO LOAD BEARING BAKUP TILE

Perspective view of 13 in. wall 8x5x12 in. and 3¾x5x12 in. Bakup Tile faced with brick. A course of Full Headers is obtainable every sixth course of brick.

"Header at 8th course is similar with addition of courses of 8 x 5 x 12" stretcher tile."



Perspective view of 13 in. wall 8 x 5 x 12 in. and 3¾ x 5 x 12 in. Bakup Tile faced with brick. A course of full headers is obtained every fifth course of brick.

"Header at 7th course is similar with addition of courses of 8 x 5 x 12" stretcher tile."

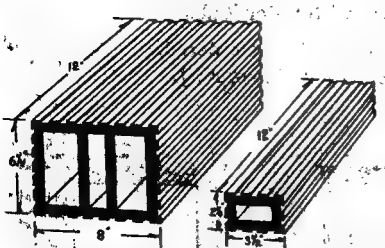
Natco Hollow Bakup Tile complies with all requirements of the Chicago Building code. It gives walls the required thickness and strength at pronounced savings in weight, foundation and steel cost, and labor. The dead air cells insulate, making the structure warmer in winter, cooler in summer.

Natco Bakups are made in two sizes—8 x 5 x 12 inch, which displaces 6 brick, and 3¾x5x12, which displaces three brick. In both sizes, it is furnished with one 5 x 12 in. face smooth and the other three sides scored. Where a smooth attractive and sanitary interior is desired, the Natco Bakup Tile is set with the smooth face on the inside. Where the usual plaster interior is called for, the surface of dove tailed scorings takes hold and grips firmly and permanently the coat of plaster.

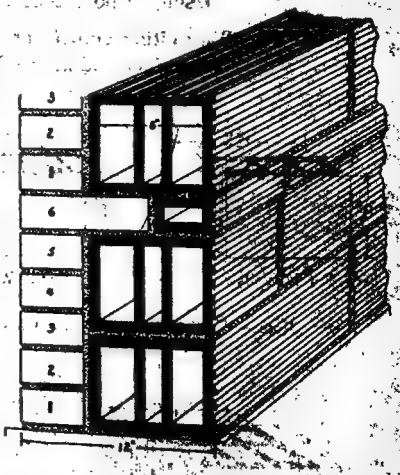
Natco Standard Glazed Bakup Tile is furnished with two 5x12" smooth faces. Suitable closures can also be supplied when required.

Natco Bakup Tile was the pioneer Hollow Tile Backing for face brick, stone, and other materials, and has for many years, and in thousands of buildings, proved its permanence, economy, desirability, and satisfaction.

NATCO UTILITY TILE



6¼" x 8" x 12" Natco Utility Tile — 2¼" x 3½" x 12" Hollow Brick used with Natco Utility Tile



Section of 12" wall, showing all tile backing of Natco Utility Tile

Natco Utility Tile comes in a size 6¼" high by 8" wide and 12" long, scored on all four sides. The height of two Utility Tile, together with a 2¼" x 3½" x12" hollow brick, allows bonding of face brick every sixth course. By the use of Natco Utility Tile, no common brick is required for backing.

Natco Utility Tile is economical as a backing for face brick in that it displaces a greater area than the ordinary 8"x5"x12" and 4"x5"x12" backup tile used with a common brick at the header course. In addition to displacing a greater area, Natco Utility Tile reduces the amount of mortar required. The saving is approximately 26% in mortar and 25% in labor. Added to this, you have an all tile backing without the use of common brick. The mason has but two units on the scaffold. It meets all openings and ceiling heights.

In the Chicago district, where this type of tile is extensively used, it has been found that there is a saving of approximately $30.00 per thousand feet in the wall in using Natco Utility Tile over other types of backing. These figures are secured by using for Natco Utility Tile the same factory base as the other competing units and the $30.00 savings is calculated from the reduction in labor cost, elimination of common brick and saving in mortar.

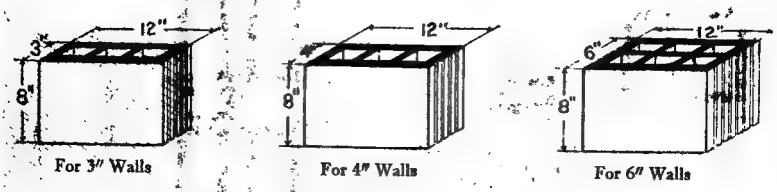
Comparative table showing number of brick required for Utility Tile Walls and for ordinary backup tile walls.

	Header Course	Brick Joint	1 Unit Ctr. to Ctr. of Header	On 1000 Sq. Ft. Basis		
				Number of Units Required	Face Brick Required	Additional Face Brick
Ordinary Back up Wall	5th course	⅜"	13⅛"	884 units	7956	186
	5th course	½"	13¾"	840 units	7560	210
	5th course	⅝"	14⅜"	800 units	7200	249
Utility Tile Wall	6th course	⅜"	15¾"	740 units	7770	—
	6th course	½"	16½"	700 units	7850	—
	6th course	⅝"	17¼"	662 units	6951	—

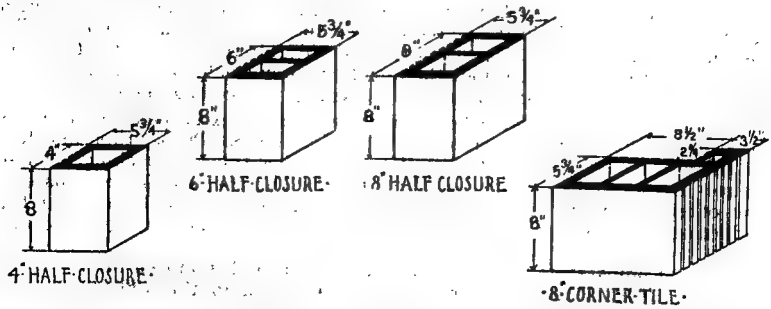
DETAILS OF NATCO FACE TILE

Used for both Exterior and Interior Walls

With either smooth or "tex" finish as ordered.
Manufactured at our factory at Natco, N. J.



Note:—3", 4", 6" and 8" Closure Tile same as Wall Tile with one end smooth



This tile is of variegated buff and reddish colors, shading from a light buff to a light red. For general use the run of kiln will be found most satisfactory.

This tile can be furnished also in a one color range (not one shade) of very pleasing effect with one face tex-finished and the other face smooth or scored.

NATCO GLAZED BUILDING BLOCKS

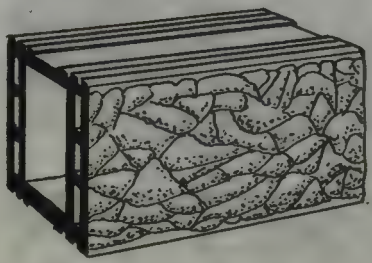
The 8″x8″x16″ block is especially suitable for residence foundations and the walls of buildings of moderate size, such as private garages, small factory buildings, warehouses and the various types of modern farm buildings.

This is furnished in the 2-cell type with the center web, and also with the exclusive Natco double shell feature, which provides wide beds for vertical mortar joints. Combination corner block and full jamb tile as well as half jamb tile for steel sash, is also furnished, to be used with either the 8″x8″x16″ 2-cell or double shell glazed Building Block.

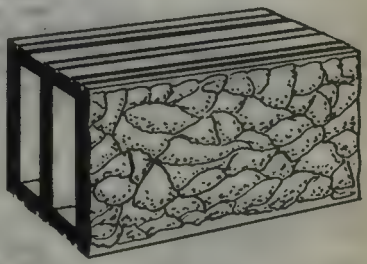
For heavier foundations and walls, the 10″x8″x16″ and the 12″x8″x16″ blocks are used. These are furnished with the center web similar to the 8″x8″x16″ size which makes them capable of withstanding very heavy loads.

The 4″x8″x16″ joist tile are used for closures at the end of joists. Short lengths, corners, closures and jambs are furnished to eliminate expensive cutting.

Showing how Natco Full and Half Jamb Tile are used with steel sash

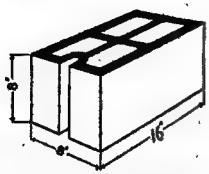


8"X 8" X 16" DOUBLE SHELL WALL TILE

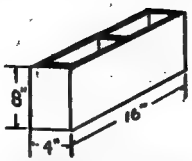


8"X 8" X 16" TWO CELL WALL TILE

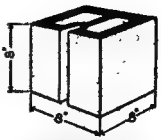
NATCO GLAZED BUILDING BLOCKS



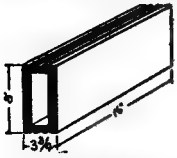
Combination Corner Block and Full Jamb for steel sash



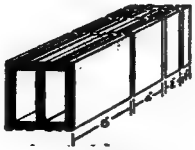
3¾" x 16" x 8" Closure Tile



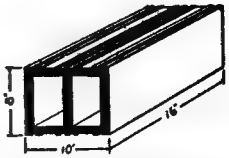
Half Jamb Tile for steel sash



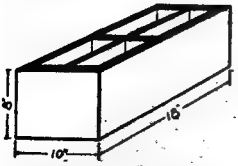
3¾" x 8" x 16" Joist and Wall Tile



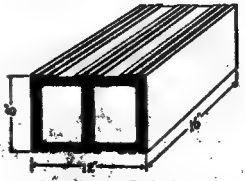
Standard Short Lengths



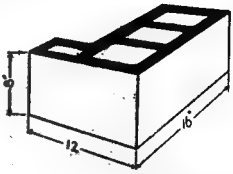
10" x 8" x 16" Wall Tile



10" x 18" x 8" Corner

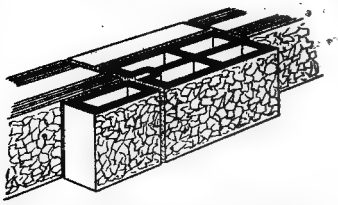


12" x 8" x 16" Wall Tile

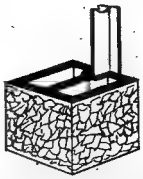


12" x 16" x 8" Corner

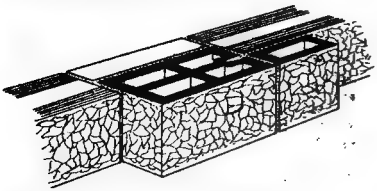
CONSTRUCTION DETAILS



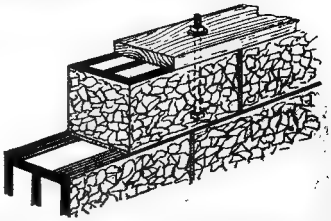
Pilaster Construction: 24½ inch pilaster with 4½ inch projection beyond face of wall. Even courses.



Method of inserting flange on steel window into slot in half jamb. Flange is then mortared in place.



Pilaster Construction: 24½ inch pilaster with 4½ inch projection beyond face of wall. Alternate courses.



Method of fastening roof plates to top of wall. Necessary corner blocks are laid, and place bolts are concreted in place as shown. Plate is then bolted on.

These illustrations merely indicate the construction possibilities of Natco Building Block. Our Engineering Department will gladly cooperate with you in working out specific applications.

Natco
Conduit

NATCO UNDERGROUND CLAY CONDUIT

Advantages of Natco Underground Clay Conduit

Protects telephone, telegraph, power, lighting, fire and police alarm and railroad signal cables, and pneumatic tubes, from storm, wind, sleet, fire, soil or chemical corrosion, electrolysis, vibration and mechanical injury.

Economical—low first cost and practically no maintenance or depreciation—makes cables ever accessible and reclaimable.

Manufactured by Pioneers

Natco Clay Conduit is made by pioneers in Clay Conduit manufacture since 1891.

Used by the foremost Utility Corporations, Railroads, Municipalities and Industries throughout the world.

General Description of Natco Conduit

Material—Natco Conduit is a rigid structure in a cellular form of vitrified clay, with salt glazed surfaces.

Design—Natco Conduit is combed or scarified on the outside surfaces, providing firm anchorage for joint and bedding mortar. It is beveled around the inner edges of ends of duct holes, making safe the pulling of cables.

Natco Conduit in all multiple and some single forms is made with dowel holes extending through entire length of each piece, thus permitting use of special steel dowel pins at joints to insure easy and positive alignment and centering of duct holes.

Natco Conduit can be obtained in the form of scored units, for splitting apart, making any part of a subway easy to break into and inspect, replace or repair.

Manufacture—Natco Underground Clay Conduit is made from special high grade clays found in few localities, finely ground, moulded and vitrified into a flintlike rock by over 2000 degrees of heat and then salt glazed to provide a permanently smooth glasslike surface.

FEATURES OF NATCO UNDERGROUND CONDUIT

Permanence

A conduit permanent in character and permanent in form. A dense, porcelainlike material, inorganic, insoluble, inert and non-combustible, that will not soften, swell, deform or disintegrate on exposure to heat, moisture, frost, steam or chemical attack—proof against rot, corrosion, oxidation and disintegration—demonstrated in 36 years of responsible service.

Non-corrosive

Absolutely free from caustic alkalis, acids or organic compounds. Any such elements are early eliminated in kiln fires by over 2000 degrees of heat.

Resistance to Chemical Attack

Natco's dense porcelain like structure and vitreous glazed surfaces are impervious to penetration and attack of acids or alkaline solutions in soils or ground waters.

Insulating Quality

Its porcelain like character makes Natco a splendid insulator with high dielectric strength.

Heat Conductance

Natco's dense glasslike walls transmit heat readily; a good conductor and dissipator of cable heat—while generous size duct holes, either round or square in shape, provide ample space for ventilation around the cable.

Fire Resistance

Non-combustible, non-inflammable, fireproof—created in fire, Natco Conduit cannot burn, ignite or generate objectionable smoke or fumes.

Strength and Rigidity

Natco is strong and rigid with high compressive strength—a permanent structural unit as well as a conduit. With ample thickness of walls and webs and balanced vitrification, providing maximum strength with maximum density. Natco will safely carry all normal street loads and stand up under severe

traffic vibration—also permits immediate backfilling of trenches. It is proof against distortion, disintegration or collapse, whether wet or dry—whether freezing or thawing.

Flexibility in Installation

Natco Conduit is extremely flexible—made both in a single duct as well as in a multiple duct form, and in many modified shapes for most conditions. It is now supplied in slant shapes for constructing curves—for building approaches to cable vaults or to submarine crossings. There are shapes for transposing position of ducts and cables in approaching manholes or cable vaults. Shapes are available for turning branches, for splaying of duct lines, approaching manholes or to circumvent obstructions. Shapes are also available for transposing and flattening out of duct banks in crossing bridges, viaducts and in passing street obstructions. There are shapes for quick, easy and cheap repairs to duct lines. Curved shapes are also available for making service connections or for turning laterals. There are new shapes for the largest cables as well as shapes for the smaller cables, all of which may effect considerable savings in installation cost by the elimination of many manholes.

Smoothness

Permanent glazed duct surfaces—glass hard, glass smooth—that never soften, swell, peel or change form, making cable pulling in Natco Conduit a safe and easy operation. Besides, every duct is scraped to insure freedom from roughness or projections and eliminate danger of damage to the cable sheath.

Alignment

Natco Conduit in all multiple and in the square bore single duct shapes, is made with dowel holes extending the entire length of every piece of conduit, thus permitting use of steel dowel pins at the joints, to insure easy and positive alignment and centering of duct holes, during installation. Natco Conduit is combed or scarified on the outside surfaces, providing firm anchorage for joint and bedding mortar. When properly laid, centered, joined and encased, Natco constitutes a fixed, permanent, monolithic conduit system.

Maintenance and Depreciation

Natco Conduit, being permanent in character and in form, requires practically no maintenance and suffers but little depreciation. There is nothing to wear out; nothing to become obsolete. In the event of damage to certain parts of the line, repairs can be very easily made by split units and the lines quickly restored to their original condition. Natco turns expense into profits.

First Costs

Natco is economical to install. The many shapes lend themselves readily to each need—each layout—with a consequent low first cost.

Made in Two Types

Two general types of Natco Conduit are manufactured: single duct and multiple duct.

Natco Single Duct Conduit—Provides two heavy insulating walls between adjacent cables and permits breaking of joints throughout every duct line. Adapted for high tension power and lighting trunk lines, single cable terminals and for low tension laterals as in telephone lines. Also adapted for splaying conduit lines on approaches to manholes. It is scarified lengthwise on four sides to provide anchorage for bedding mortar. Large bore single duct provided with through dowel holes in corners.

Natco Multiple Duct Conduit—Provides longer lengths and multiplicity of duct holes—through dowel holes in all shapes permit positive means of alignment. Economical and quick to install. Adapted for low tension, telephone, telegraph, railway signal, power and lighting service. It is scarified around the outside near each end to provide anchorage for joint mortar.

Natco Service

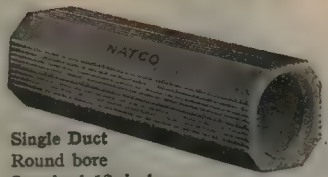
The largest manufacturers of clay conduit in the world. A broad service policy assures satisfaction.

Full stocks and eight large manufacturing plants insure prompt shipments carefully packed. Special shapes can be made and shipped on comparatively short notice. Quality maintained for over 36 years.

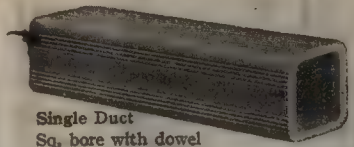
FIELDS OF USE—NATCO UNDERGROUND CLAY CONDUIT

For	Where Used	
TELEPHONE COMPANIES		
Telephone cables	Local exchange systems	Under city streets
	" " "	In subway structures
	" " "	In elevated highways
	" " "	In bridges and viaducts
	" " "	In R. R. terminals
	" " "	In submarine crossings
	Telephone exchange bldgs.	In riser walls
	Telephone toll lines	
	Toll line repeater stations	
PUBLIC UTILITY POWER COMPANIES		
High and low voltage electric power cables	Light and power distribution	Under city streets In bridges In submarine crossings In power and sub stations
MUNICIPALITIES		
Telephone cables Power dist. cables Street lighting cables Traffic control cables Fire and police alarm teleg. cables Telegraph cables	Municipal cable subways Municipal transport. subways Municipal airports Municipal power plants Municipal hospitals and jails Municipal universities	Under city streets In elevated highways In bridges and viaducts
RAILROADS		
Signal power cables Telegraph cables Telephone cables Electric power feeder cables for train operation Pneumatic tubes		In roadbeds In terminals In track elevation In bridges and viaducts In tunnels and subways
AIRWAYS		
Electric power and lighting cables Telephone cables Telegraph cables Signal cables		In airports and landing fields
STREET RAILWAYS		
Electric power feeder cables		In roadbed Under city streets In bridges and viaducts In tunnels or subways
TELEGRAPH COMPANIES		
Telegraph cables Pneumatic tubes		Under city streets In R. R. terminals In R. R. track elevations In bridges or viaducts In tunnels or subways
INDUSTRIAL PLANTS		
Electric power cables Fire alarm cables Signal cables Pneumatic tubes		From power plant or substation to plant building Under plant buildings
NATIONAL GOVERNMENTS		
Electric power and lighting cables Signal cables Telephone cables Telegraph cables	Government power plants Army posts Signal corps Navy yards Government prisons Government hospitals Government airports Government canals Government hydraulic projects National highways, bridges and tunnels	
STATE AND PRIVATE INSTITUTIONS		
Telephone cables Signal cables Electric power and lighting cables	Universities Hospitals Prisons Asylums Power plants Highway bridges and viaducts Vehicular tunnels	

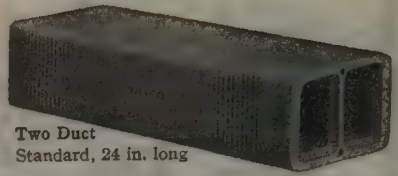
SIZES AND STYLES OF NATCO CLAY CONDUIT



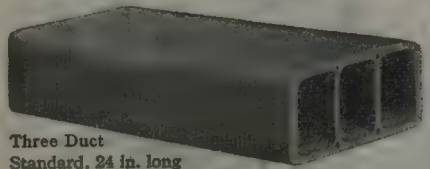
Single Duct
Round bore
Standard 18. in long



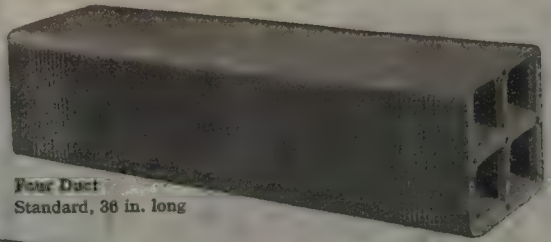
Single Duct
Sq. bore with dowel holes, 18 in. long



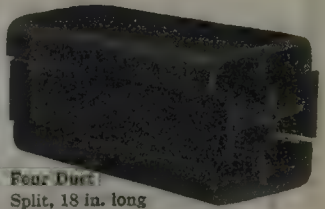
Two Duct
Standard, 24 in. long



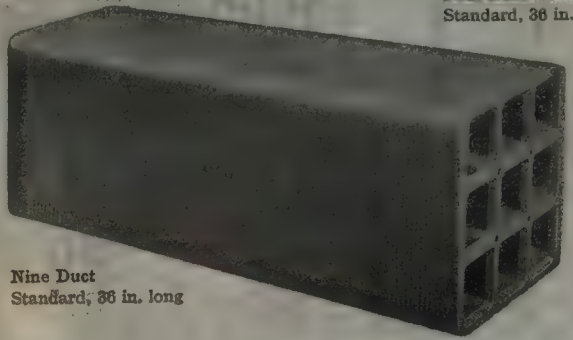
Three Duct
Standard, 24 in. long



Four Duct
Standard, 36 in. long

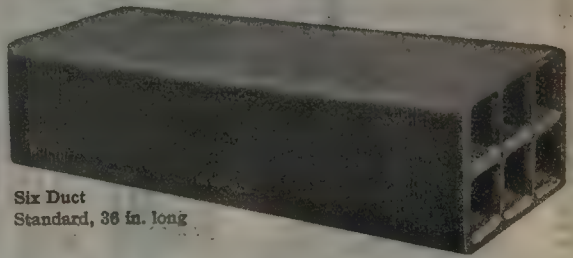


Four Duct
Split, 18 in. long



Nine Duct
Standard, 36 in. long

Six Duct Slant
(Flat Position)



Six Duct
Standard, 36 in. long

NATCO UNDERGROUND CLAY CONDUIT STANDARD SHAPES AND SIZES

Single Duct

Duct holes: Number per piece	Duct holes: Standard bore, in.	Number of dowel holes	Standard length in.	Duct feet per piece	Actual size of duct hole, in.	Approximate outside dimensions, in.	Lengths in which short pieces are made, in.	Minimum car load, duct feet
1	3¼ round	0	18	1½	3⅝	4½x 4½	6, 9, 12	7800
1	3½ round	0	18	1½	3⅝	4⅞x 4⅞	6, 9, 12	6900
1	4 round	0	18	1½	4⅛	5⅜x 5⅜	6, 9, 12	6000
1	4¼ round	0	18	1½	4⅝	5⅝x 5⅝	6, 9, 12	5700
1	3¼ square	4	18	1½	3⅝	4¾x 4¾	6, 9, 12	6100
1	3½ square	0	18	1½	3⅝	5 x 5	6, 9, 12	5700
1	4¼ square	4	18	1½	4⅝	5⅞x 5⅞	6, 9, 12	4800

Multiple Duct

2	3¼ square	2	24	4	3⅝	4¾x 8¾	6, 8, 12	7600
3	3¼ square	4	24	6	3⅝	4¾x12¾	6, 8, 12	7500
4	3¼ square	5	36	12	3⅝	8¾x 8¾	6, 9, 12	8400
6	3¼ square	2	36	18	3⅝	8¾x12¾	6, 9, 12	9000
8	3¼ square	3	36	24	3⅝	8¾x16¾	6, 9, 12	9000
9	3¼ square	4	36	27	3⅝	12¾x12¾	6, 9, 12	9000
2	3½ square	2	24	4	3⅝	5⅛x 9⅝	6, 8, 12	6400
3	3½ square	4	24	6	3⅝	5⅛x13⅝	6, 8, 12	6900
4	3½ square	5	36	12	3⅝	9⅝x 9⅝	6, 9, 12	7500
6	3½ square	2	36	18	3⅝	9⅝x13⅝	6, 9, 12	8100
2	4¼ square	2	24	4	4⅝	5 11/16x11	6, 8, 12	5200
3	4¼ square	4	24	6	4⅝	5 11/16x16 1/16	6, 8, 12	5400
4	4¼ square	5	36	12	4⅝	11 x11	6, 9, 12	6000
6	4¼ square	2	36	18	4⅝	11 x16 1/16	6, 9, 12	6300
9	4¼ square	4	24	18	4⅝	16 1/16x16 1/16	6, 9, 12	6800

Scored or Split Shapes

1	All standard bores	..	18	..	....	.....	6, 9, 12	....
2 and 3		..	18	..	....	.....	6, 8, 12	....
4 and 6		..	18	..	....	.....	6, 9, 12	....
8 and 9		..	18	..	....	.....	6, 9, 12	....

SLANTS OR MITERED CONDUIT

Number of duct holes per piece	Standard bore	Length, in.	Angle in degrees	Nominal radius, ft.	Position
1	All standard bores	6x6¾	3	10	.....
2, 4, 9		6x6¾	3	10	.....
3, 6, 8		6x6¾	3	10	edge or flat

Note: Natco Branch Conduit and Natco Transposition Conduit also supplied in all standard shapes.

SINGLE DUCT BENDS

Standard bore, inches	Angle, in degrees	Radius inches
3¼ round	90 and 45	12, 18, 24, 30 and 36
3½ round	90 and 45	12, 18, 24, 30 and 36
3½ square	90 and 45	12, 18, 24, 30 and 36

Bends can be supplied either split or solid. Special angles or radius made to order.

Natco Fireproofing

NATCO PARTITION TILE

In addition to their fire-resisting qualities, structural clay tile partitions are light, strong, easily handled by bricklayers, and do not transmit heat, cold or sound.

All partitions and furring tile, unless otherwise specified, are scored to receive plaster.

Wood or channel iron bucks are placed in all door openings, and should be 1½″ wider than thickness of the tile and act as grounds for the plastering.

It is not generally practicable to use 2″ tile for partitions, except for closets, shafts, etc.

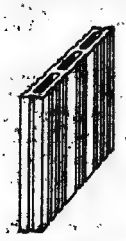
Partitions of 3″ can be safely used up to 12′ in height, 4″ to 16′ and 6″ to 20′.

The tile are commonly made 12″ wide by 12″ long, except 2″ tile at Eastern and Northeastern factories, which is made 12″ long but 8″ wide at Eastern factories and 6″ wide at the Northeastern factory. They can be made any size required, but special sizes are necessarily more expensive.

In office buildings it is good practice to have all elevator enclosures of 6″, all main corridors and stairway enclosures of 4″ and the partitions between rooms 3″. Partitions should be bonded where meeting and anchored to wood bucks or brick walls by using 10d nails, or metal wall ties, in each second joint.

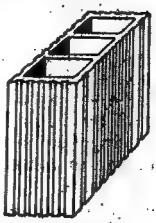
Natco Smooth Partition Tile (Glazed or Unglazed):

At a slightly increased cost, Natco Partition Tile, either glazed or unglazed, is made smooth on either one or two faces, as desired. The smooth, sanitary,

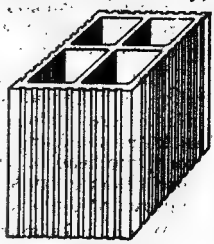


2 inch
Eastern Factories
3-cell—2x8x12—10 lb.
Ohio Factories
3-cell—2x12x12—15 lb.
Western Factories
3-cell—2x12x12—15 lb.

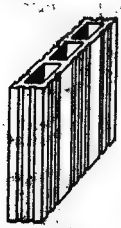
4x12x12
Eastern Factories
3-cell—16 lb.
Ohio Factories
3-cell—16 lb.
Western Factories
3-cell—16 lb.



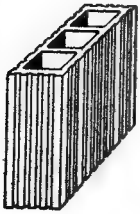
6x12x12
Eastern Factories
4 and 6 cell—22 and 24 lb.
Ohio Factories
3-cell—22 lb.
Western Factories
3-cell—22 lb.



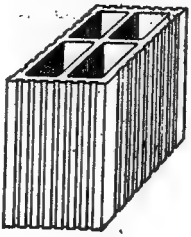
10x12x12
Eastern Factories
6-cell—36 lbs
Ohio Factories
4-cell—36 lb.
Western Factories
6-cell—36 lb.



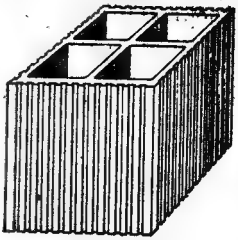
3x12x12
Eastern Factories
3-cell—15 lb.
Ohio Factories
3-cell—15 lb.
Western Factories
3-cell—15 lb.



5x12x12
Eastern Factories
6-cell—22 lb.
Ohio Factories
3-cell—19 lb.
Western Factories
3-cell—19 lb.



8x12x12
Eastern Factories
6-cell—30 lb.
Ohio Factories
6-cell—30 lb.
Western Factories
6-cell—30 lb.



12x12x12
Eastern Factories
6-cell—40 lb.
Ohio Factories
6-cell—40 lb.
Western Factories
6-cell—40 lb.

Note: Additional shapes available at Ohio factories: 5x12x12—6 cell—26 lb., 6x12x12—6 cell—28 lb., 7x12x12—3 cell—25 lb., 7x12x12—6 cell—30 lb., 8x12x12—6 cell—32 lb., 9x12x12—4 cell—32 lb.

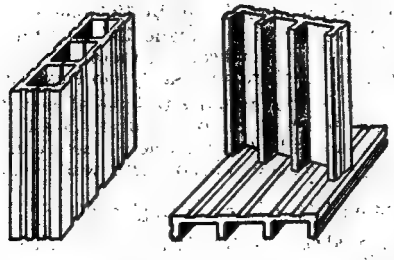
easily cleaned interior surfaces of the tile walls, make it very desirable for warehouses, industrial plants, elevator shafts and similar applications.

Glazed or unglazed backing up tile, with smooth face, can also be furnished to be used in combination with smooth partition tile.

Standard thicknesses of this material are 4″, 6″ and 8″. Other sizes of smooth partition tile will be manufactured if sufficient quantities are ordered.

Standard glazed or unglazed partition tile, with one or two faces smooth, are always furnished with one end smooth so that tile can be used as a closure or lintel in addition to its use as wall tile.

NATCO SPLIT FURRING TILE

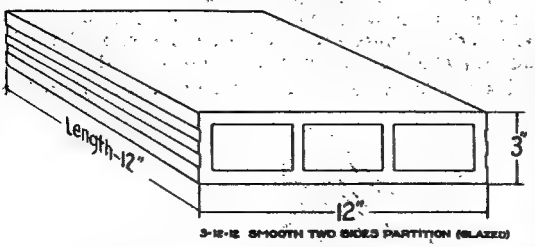


Brick walls exposed to the weather must be furred with hard burned tile, to prevent dampness reaching the interior and destroying the plastering and interior decorations.

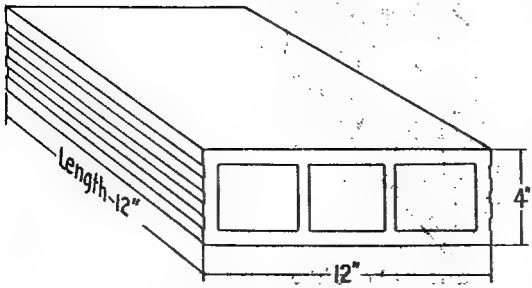
The tile are made either 1½″ or 2″ thick and 12″ square. The ribs being set against the wall, an air space is formed which effectively checks the passage of moisture. They should be set with the ribs vertical without mortar at back and fastened to the wall by driving 10d nails in the joints of the brickwork, the head of the nail being bent down upon the tile, using a nail every third tile in every second course or metal wall ties may be embedded in wall, as provided by local building codes.

Where walls must be straightened or furred out to line with face of piers the 2″ tile cannot be used. If ceiling height is not too great use 3″ partition tile. If the space is greater than 3″ the tile may be set out from the wall leaving a clear space behind them. They should be braced at intervals by the use of drive anchors or 4″ tile can be used without the anchors. This is known as free standing furring. The face of the tile is grooved for plastering.

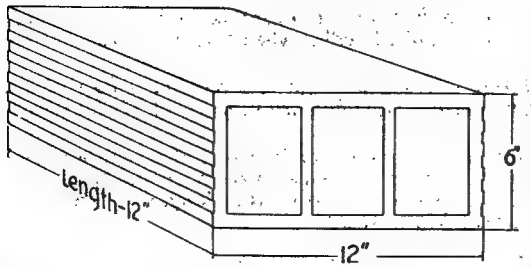
SMOOTH PARTITION TILE (Glazed or Unglazed)



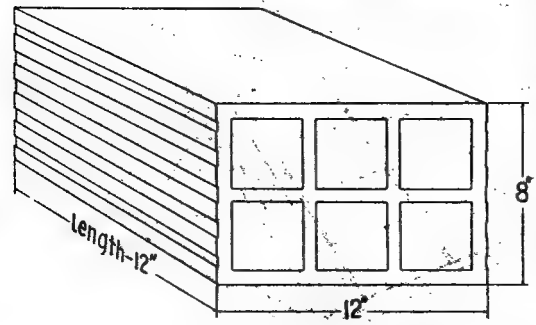
3-12-12 SMOOTH TWO SIDES PARTITION (GLAZED)



4-12-12 SMOOTH TWO SIDES PARTITION (GLAZED)



6-12-12 SMOOTH TWO SIDES PARTITION (GLAZED)



8-12-12 SMOOTH TWO SIDES PARTITION (GLAZED)

At a slightly increased cost, Natco Partition Tile, either glazed or unglazed, is made smooth on either one or two faces, as desired. The smooth, sanitary, easily cleaned interior surfaces of the tile walls, make it very desirable for warehouses, industrial plants, elevator shafts and similar applications.

Glazed or unglazed backing up tile, with smooth face, can also be furnished to be used in combination with smooth partition tile. Standard thicknesses of this material are 4 in., 6 in. and 8 in. Other sizes of smooth partition tile will be manufactured if sufficient quantities are ordered.

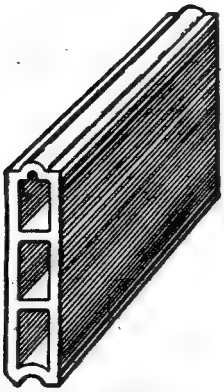
Standard glazed or unglazed partition tile, with one or two faces smooth, are always furnished with one end smooth so that tile can be used as a closure or lintel in addition to its use as wall tile.

Natco Smooth Partition Tile can be kerfed for splitting for use as a half closure.

NATCO BOOK TILE

On account of their shape these tile are called "Book Tile," and they are made especially for roofs to be covered with concrete, tar and felt or any composition roofing. They are made of uniformly hard-burned material 3″ thick, and of a length depending very much upon the weight to be carried.

The steel framework T's should be spaced 1″ wider on centers than the length of the tile.

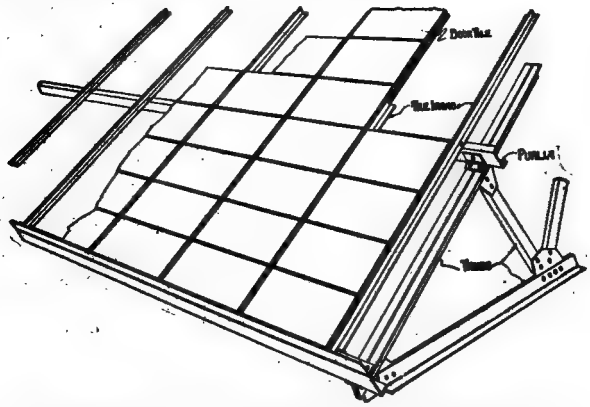


Standard Book Tile

Book tile are used for covering the flat roofs of penthouses, bulk-heads, etc., and may be used for main flat roof of a building when only light live loads are anticipated.

When providing for future increase in height of a building a floor of flat arches is set and roof grading placed on temporary supports of T's (or dwarf-walls), and book tile.

Natco Book Tile permits a minimum of condensation of moisture underneath due to its high insulating qualities. This makes it invaluable for the protection of manufacturing processes, such as glass making, etc., where the product might be injured by the drip of water.



Book Tile in Place on Structural Steel Roof Construction

NATCOFLOR

Description:

Natcoflor System is a combination of special shaped Natco tile with 2" wide cement grout joists or ribs spaced 13" center to center between the tile. Each rib is reinforced with two steel bars, one straight and one bent.

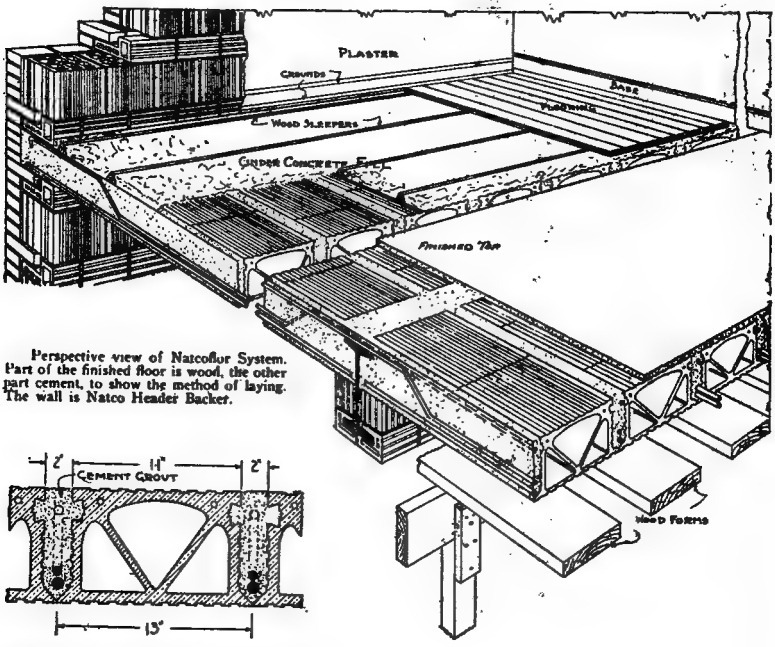
No concrete is required on top of the tile for structural purposes. Finish may be applied directly upon the rough tile floor.

The design of the tile is such as to place the maximum sectional area of the tile unit where it will be of the most use in resisting the compressive stresses. The dead weight of the tile thus has been kept down to the minimum. In other forms of "Combination" systems, these stresses are taken care of by the concrete top. The tile are made from special clay which gives them high compressive strength. Tests have repeatedly and clearly demonstrated that tile may be safely figured to take compressive stresses of 1000 pounds per sq. in. of net sectional area, allowing an ample factor of safety.

Cement grout or mortar mixed one part cement to two and one-half parts sand is used for the 2" joists. This thoroughly covers the steel reinforcing and completely fills the joints between the tile. (At girders, etc. where the open ends of the tile are exposed, the tile are first placed on end and the cells stopped with about 1" of mortar.) The flanges of the tile meet at the bottom to form an all tile ceiling thus assuring an excellent base for plastering.

With Natcoflor, greater speed of erection at a much lower cost is secured. This is due to the perfect alignment of the tile, small amount of material required for reinforced joists and the extremely light dead load as compared with other strictly fireproof floors.

Our engineers will be glad to give architects and designers any assistance required in using this construction.



Perspective view of Natcoflor System. Part of the finished floor is wood, the other part cement, to show the method of laying. The wall is Natco Header Backer.

Notice in the detail view, how the tile meet at the bottom, to form an all-tile ceiling.

Tile Depth and Steel Area "Natcoflor" Combination Long Span Floors
No Cement Top, 2" Mortar Ribs 13" O. C.

f_m and $f_t = 1000$ lb. per sq. in.
$f_s = 16{,}000$ lb. per sq. in.

$\frac{E_t}{E_s} = \frac{1}{10}$

¾" mortar below reinforcement.
S = Area of steel per joist, sq. in.
T = Depth of tile, in. = depth of floor.

Total safe load (dead plus live), pounds per square foot		150		165		180		195		210		225		240		260		300		335	
	Continuous span $M = \frac{WL}{12}$																				
	Semi-continuous span $M = \frac{WL}{10}$	125		135		150		160		175		185		200		220		250		280	
	Simple span $M = \frac{WL}{8}$	100		110		120		130		140		150		160		175		200		225	
Span in feet		T	S	T	S	T	S	T	S	T	S	T	S	T	S	T	S	T	S	T	S
6		4	.16	4	.17	4	.19	4	.20	4	.22	4	.23	4	.25	4	.28	4	.31	4	.35
7		4	.21	4	.23	4	.26	4	.27	4	.30	4	.32	4	.34	4	.38	5	.32	5	.36
8		4	.28	4	.30	4	.33	4	.36	4	.39	5	.31	5	.33	5	.37	5	.42	5	.47
9		4	.35	4	.38	5	.32	5	.34	5	.37	5	.39	5	.42	5	.46	5	.53	6	.46
10		5	.33	5	.35	5	.39	5	.42	5	.46	5	.48	5	.52	6	.45	6	.51	6	.57
11		5	.39	5	.43	5	.47	5	.50	6	.43	6	.46	6	.49	6	.54	6	.62	7	.57
12		5	.47	5	.51	6	.44	6	.47	6	.51	6	.54	6	.59	6	.65	7	.61	7	.68
13		6	.43	6	.47	6	.52	6	.55	6	.60	6	.64	7	.57	7	.63	7	.71	8	.67
14		6	.50	6	.54	6	.60	6	.64	7	.58	7	.61	7	.66	7	.73	8	.70	8	.78
15		6	.57	6	.62	7	.57	7	.61	7	.67	7	.70	7	.76	8	.70	8	.80	9	.78
16		6	.65	7	.58	7	.65	7	.69	7	.76	8	.67	8	.73	8	.80	9	.79	9	.89
17		7	.61	7	.66	7	.73	8	.66	8	.72	8	.76	8	.82	9	.79	9	.90	10	.89
18		7	.68	7	.74	8	.69	8	.74	8	.81	9	.74	9	.80	9	.88	10	.89	10	1.00
19		7	.76	8	.69	8	.77	8	.82	9	.78	9	.83	9	.89	10	.88	10	.99	12	.90
20		8	.71	8	.77	8	.85	9	.79	9	.87	9	.92	10	.88	10	.97	12	.89	12	1.00
21		8	.78	8	.85	9	.82	9	.88	10	.85	10	.90	10	.97	12	.87	12	.98	12	1.10
22		9	.75	9	.81	9	.90	10	.85	10	.93	10	.99	12	.86	12	.95	12	1.08	.....	.....
23		9	.82	9	.89	10	.87	10	.93	12	.83	12	.87	12	.94	12	1.04	12	1.18	.....	.....
24		9	.89	10	.86	10	.95	12	.82	12	.90	12	.95								
25		10	.86	10	.93	12	.84	12	.89	12	.97	12	1 03								
26		10	.93	12	.81	12	.90	12	.96	12	1.05	12	1.12								
27		12	.81	12	.88	12	.97	12	1.04	12	1 13										
28		12	.87	12	.94	12	1.05	12	1.12												
29		12	.94	12	1.01	12	1.12	12	1.20												
30		12	1.00	12	1.08	12	1.20	.....	.....												

Design Data

Size, in.	4	5	6	7	8	9	10	11	12
Mortar per sq. ft....cu. ft.	.051	.064	.077	.090	.102	.115	.128	.141	.154
Wt. of tile .....lb.	26	28	30	32	34	37	40	44	47
Wt. of floor...lb. per sq. ft	30	34	39	42	45	48	52	56	59

Note: Unit shear not to exceed 60 lb. per sq. in. Width of joist may be figured 3½" in computing shear (2" for joist and ¾" for each adjoining shell of tile).

Special Features:

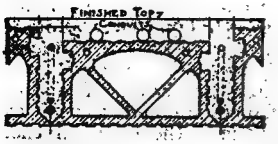
Saves Dead Load—In either steel or concrete frame and foundation.

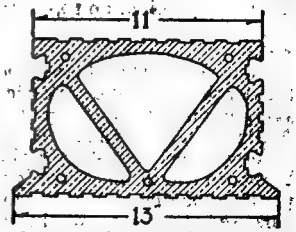
Saves Floor Depth—2" to 4" less than other construction.

Saves Plastering—No metal lath or suspended ceiling. A continuous tile surface.

Saves Labor Cost—Permits speedy erection the year around.

Saves Insurance—Strictly fireproof construction.





Negative Moment and Shear Tile.

Conduits:

When cement or terrazzo floors are used, a run for conduit may be easily made by putting in a series of tile less in depth than the rest of the floor. In the case of wood floors, the conduit may be run between the sleepers.

Negative Moment and Shear Tile:

Our organization is able to furnish a special Natcoflor tile for use adjacent to the supporting members to take care of an excessive negative moment or shear at these points. This tile is so designed that the compressive area at lower portion of the tile is the same as the area in the upper portion besides having the additional key for the grout at the bottom. Generally two or three pieces of this special tile are required adjacent to the supporting member, depending on the designer's requirements. In some cases they would not be needed.

The advantages of this tile are that in some cases a saving in depth and cost of floor may be obtained. For example, a floor must sometimes be increased in depth because of excessive shear or negative moment although it meets the other design requirements. The tile weighs little more than the ordinary Natcoflor and the dead weight of the floor as a whole is not affected.

TYPICAL SPECIFICATION FOR NATCOFLOR

Fireproofing:

The floor construction shall be what is known as "NATCOFLOR" system which consists of special Structural Clay tile with flanges at the bottom forming a tile ceiling, and 2" wide mortar joists 13" on center between the tile. Each joist shall be reinforced with 2 steel bars at the bottom, one to be bent and one straight. The bent bars shall extend up and continue over the point of support, where possible to the ¼ point of the adjacent span. No concrete or mortar is required on top of the tile for structural purposes.

Tile:

The size of the tile shall be as called for on the plans. The sizes given are the depth of the tile. All tile shall be of hard burned fire clay, free from damaging impurities and large defects and properly scored on all exterior surfaces. Actual weight of tile shall not vary more than 5% over or under weight for different sizes published by the National Fire Proofing Corporation. Tile shall be placed end to end in straight rows with bottom flanges and ends as tight as possible together. Break joints in alternate rows of tile by the use of half tile. Tile used at ends of rows shall be stood on ends and stopped with a small quantity of mortar. Rows of tile should line up from span to span. All tile must be wet before pouring mortar to insure a good bond.

Steel Reinforcing:

Bars shall be of a deformed type meeting the specification of the A.S.T.M., and of sizes shown on drawings. Before placing into position, bars must be clean and free from rust or scale, adhering material, oil or any other substance tending to destroy the bonding qualities.

Cement:

American Portland Cement to conform to the A.S.T.M. specifications.

Sand:

Sand shall consist of quartz grains or other hard material, clean and free from any surface film coating and graded from fine to coarse. Shall not contain injurious vegetable or other organic matter or more than 5% by volume of clay or loam.

Mortar:

Mortar for 2" joist between the tile shall be mushy grout, not too wet, and shall consist of one part by volume of cement and 2½ parts sand and shall be mixed in a batch mixer. Mortar shall be dumped on top of tile and swept into place in joists between tile, so that all joists and joints are properly filled. Mortar shall be puddled so that steel reinforcement is completely encased in mortar.

NATCO COMBINATION LONG SPAN FLOORS

Natco One Way System—General

The Natco Combination One Way System is particularly adapted to all classes of buildings where long span fireproof floors are required without the beams showing in the ceilings. The Natco Structural Clay Tile in combination with the load bearing concrete reduces the dead load and provides a good plastering surface. The tile make permanent forms in which are cast the series of connected concrete "T's."

The tile in a line of units are all in contact, and hold each other securely in the proper positions. They are not displaced in pouring the concrete, and no realignment is necessary.

The naturally strong adhesive bond between tile and concrete, aided by the mechanical bond of the dovetail scorings on the tile, produce a monolithic effect.

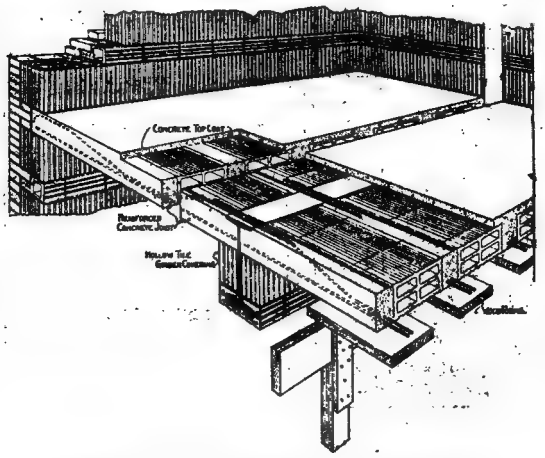
In these floors, the Natco Structural Clay Tile fireproofs the load carrying concrete of the beams against the flames of a fire below. Without this protection, a fire is likely to cause spalling, rapid weakening of the floor, and ultimate failure.

Special Two Way System Tile

Besides our regular one way system of combination floor we are able to furnish a special tile adaptable for a two way system of combination floor.

This special Natco tile is a Structural Clay tile block with no extra for openings, which prevents the concrete from entering the cells as would be the case if ordinary floor tile were used.

The design of the two way system is similar to the one way, the joists running in two directions at right angles instead of one which distributes the load in two directions. This floor has the advantages of decreasing the depth of slab, eliminating deep spandrel beams, and giving a very rigid floor laterally. No additional cross-bracing is required, which is a very important consideration in tall buildings subjected to high wind stresses.



Perspective View of Typical One Way Combination Floor

Tile Depth and Steel Area Required, One Way Combination Floor Slabs, 2" Concrete Top, Joists 4" wide, 16" O.C.

fc.=650 lb. per sq. in.
fs.=16,000 lb. per sq. in. $\frac{Ec}{Es}=\frac{1}{15}$
Shear, 60 lb. per sq. in.

¾" of concrete below reinforcement.
T=Tile; S=Steel.

*If moment $\frac{WL}{12}$ is used, investigate design for shear.

Total safe load (dead plus live), pounds per square foot																												
	Continuous Span $M=\frac{WL^*}{12}$	150		165		180		195		210		225		240		260		300		335		375		450				
	Semi-continuous span $M=\frac{WL}{10}$	125		135		150		160		175		185		200		220		250		280		310		375				
	Simple span $M=\frac{WL}{8}$	100		110		120		130		140		150		160		175		200		225		250		300				
Span in feet		T	S	T	S	T	S	T	S	T	S	T	S	T	S	T	S	T	S	T	S	T	S	T	S	T	S	
6												3	.20	3	.22	3	.24	3	.28	4	.24	4	.27	5	.27			
7		3	.19	3	.20	3	.22	3	.24	3	.26	3	.28	3	.30	4	.26	4	.30	5	.27	5	.30	6	.31			
8		3	.24	3	.26	3	.29	3	.31	3	.34	3	.36	4	.31	4	.34	5	.32	5	.36	6	.34	7	.35			
9		3	.31	3	.33	3	.37	3	.40	4	.34	4	.36	4	.39	5	.35	5	.40	6	.38	7	.37	8	.40			
10		3	.38	3	.41	3	.46	4	.39	4	.42	4	.45	5	.40	5	.44	6	.42	7	.41	8	.41	9	.44			
11		3	.46	4	.39	4	.44	4	.47	5	.42	5	.45	5	.48	6	.45	7	.45	8	.50	8	.49	10	.48			
12		4	.43	4	.47	4	.52	5	.46	5	.50	5	.53	6	.49	6	.54	7	.53	8	.53	10	.47	12	.48			
13		4	.51	4	.55	5	.50	5	.54	5	.59	6	.53	6	.57	7	.55	8	.55	9	.55	10	.56	12	.57			
14		4	.59	5	.53	5	.58	5	.63	6	.58	6	.61	7	.58	7	.64	8	.64	10	.58	12	.54	15	.53			
15		5	.56	5	.61	5	.67	6	.61	6	.67	7	.61	7	.66	8	.65	9	.66	10	.67	12	.63	15	.61			
16		5	.64	5	.69	6	.65	6	.70	7	.66	7	.70	8	.67	9	.66	10	.68	12	.64	12	.71	15	.70			
17		6	.61	6	.67	6	.74	7	.68	7	.75	8	.70	8	.76	9	.75	10	.77	12	.73	15	.65					
18		6	.69	6	.75	6	.82	7	.77	8	.74	8	.78	9	.76	10	.76	12	.73	12	.81	15	.73					
19		6	.76	6	.83	7	.80	7	.86	8	.83	9	.78	9	.85	10	.85	12	.81	15	.73	15	.81					
20		7	.74	7	.80	7	.89	8	.84	8	.91	9	.85	10	.88	12	.79	12	.90	15	.81	15	.90					
21		7	.81	7	.89	8	.87	8	.93	9	.91	9	.96	10	.94	12	.87	15	.80	15	.90							
22		7	.89	8	.86	8	.95	9	.91	9	.99	10	.95	12	.87	12	.95	15	.88	15	.98							
23		8	.86	8	.93	8	1.03	9	.98	10	.98	10	1.03	12	.94	12	1.03	15	.95									
24		8	.94	8	1.02	9	1.01	9	1.08	10	1.07	12	.96	12	1.03	15	.92	15	1.05									
25		8	1.02	9	1.00	9	1.10	10	1.07	12	.98	12	1.03	12	1.12	15	1.00	15	1.13									

Note: Based on safe loads indicated, the thickness (inches) and the areas of reinforcement (square inches per joist) are the figures for average conditions, and are for general information only. Each particular operation should be designed in accordance with actual conditions.

The Natco Engineering Department is at the disposal of any one desiring further information.

Weight of Combination Slabs Per Square Foot

Tile, in.	3	4	5	6	7	8	9	10	12	15
Weight, lb.	45	50	55	60	65	70	75	80	90	105

Note: Load tables for general information only, as each particular operation should be designed in accordance with actual conditions.

Quantities Of Concrete And Weight Per Sq. Ft.

Of Slab In Combination Floors

Thickness Of Concrete & Tile Min. a & b	Eff. Depth Min. d	4" Joist Mk C			5" Joist Mk C			6" Joist Mk C		
		Weight Per Ft.	Cub. Ft.	Cub. Yd.	Weight Per Ft.	Cub. Ft.	Cub. Yd.	Weight Per Ft.	Cub. Ft.	Cub. Yd.
4"+1½"	4½"	42	.208	.0077	45	.223	.0082	45	.256	.0087
5"+1½"	5½"	47	.229	.0085	49	.242	.0091	51	.262	.0097
6"+1½"	6¼"	53	.251	.0093	55	.272	.0100	57	.292	.0108
7"+1½"	7¼"	58	.271	.0100	60	.296	.0109	63	.320	.0108
8"+1½"	8¼"	65	.292	.0108	67	.321	.0118	70	.348	.0129
9"+1½"	9"	68	.312	.0115	72	.342	.0127	76	.375	.0139
10"+1½"	10"	74	.333	.0123	78	.369	.0136	81	.403	.0145
12"+1½"	12"	84	.375	.0138	88	.415	.0155	93	.452	.0167
4"+2"	5"	48	.251	.0093	50	.265	.0098	51	.279	.0103
5"+2"	6"	53	.271	.0100	55	.290	.0107	57	.303	.0112
6"+2"	6¾"	59	.292	.0108	60	.314	.0116	63	.333	.0123
7"+2"	7¾"	64	.312	.0115	66	.338	.0125	68	.362	.0134
8"+2"	8¾"	71	.333	.0123	74	.363	.0134	76	.390	.0144
9"+2"	9½"	74	.353	.0130	78	.388	.0143	81	.416	.0154
10"+2"	10½"	80	.375	.0138	84	.412	.0152	88	.445	.0165
12"+2"	12½"	90	.417	.0153	95	.461	.0170	99	.506	.0187
4"+2½"	5½"	51	.291	.0108	55	.306	.0113	57	.319	.0118
5"+2½"	6½"	59	.312	.0115	62	.330	.0122	63	.347	.0128
6"+2½"	7¼"	64	.333	.0123	67	.355	.0131	69	.374	.0138
7"+2½"	8¼"	70	.353	.0130	72	.379	.0140	75	.402	.0149
8"+2½"	9¼"	76	.375	.0138	79	.404	.0149	81	.431	.0159
9"+2½"	10"	80	.394	.0145	84	.429	.0158	87	.458	.0170
10"+2½"	11"	86	.417	.0153	90	.453	.0167	93	.486	.0180
12"+2½"	13"	96	.457	.0169	101	.405	.0187	105	.541	.0200
4"+3"	6"	60	.333	.0123	61	.347	.0128	63	.361	.0133
5"+3"	7"	65	.353	.0130	67	.372	.0137	69	.389	.0144
6"+3"	7¾"	71	.375	.0138	73	.397	.0146	77	.416	.0154
7"+3"	8¾"	76	.394	.0145	78	.421	.0155	81	.445	.0165
8"+3"	9¾"	82	.415	.0153	85	.446	.0165	88	.472	.0175
9"+3"	10½"	86	.436	.0161	90	.470	.0174	92	.500	.0185
10"+3"	11½"	92	.457	.0169	96	.494	.0183	99	.528	.0195
12"+3"	13½"	102	.499	.0184	107	.544	.0201	111	.583	.0216
6"+3½"	8¼"	77	.415	.0153	79	.439	.0162	81	.458	.0170
7"+3½"	9¼"	81	.436	.0161	84	.463	.0171	86	.486	.0180
8"+3½"	10¼"	88	.457	.0169	92	.488	.0180	94	.514	.0190
9"+3½"	11"	92	.478	.0177	96	.515	.0190	99	.542	.0200
10"+3½"	12"	98	.499	.0184	102	.537	.0199	105	.570	.0211
12"+3½"	14"	106	.541	.0201	115	.586	.0217	117	.625	.0231
8"+4"	10¾"	95	.499	.0184	97	.529	.0196	100	.556	.0206
9"+4"	11½"	98	.520	.0192	101	.554	.0205	105	.583	.0216
10"+4"	12½"	104	.541	.0200	108	.578	.0214	111	.611	.0226
12"+4"	14½"	115	.583	.0216	119	.627	.0232	123	.666	.0247

Weight and Areas of Reinforcing Bars

Size in in.	¼	⅜	½	⅝	¾	⅞	1	1⅛	1¼
Square Bars									
Area in sq. in.	.06		.25				1.00	1.26	1.56
Weight per ft. in lb.	.21		.85				3.43	4.34	5.35
Round Rods									
Area in sq. in.	.05	.11	.19	.30	.44	.60	.78		
Weight per ft. in lb.	.17	.38	.66	1.05	1.52	2.06	2.60		

NATCO "COMBINATION" TILE AND CONCRETE FLOORS
APPLICATION OF SYSTEM

Natco combination floors are particularly adapted to all classes of buildings where long span fireproof floors are required without beams showing in the ceilings. Structural clay tile in combination with the load-bearing concrete, reduces the dead load and provides a good plastering surface.

Much in the same way that the modern I-beam was developed from the original rectangular beam by cutting away the inert material on either side until the I shape was developed, so the modern combination long-span hollow tile and concrete floor slab was developed from the original solid slab by cutting away the inert concrete below the neutral axis until a series of connected T-shapes remained. The Natco Structural Clay Tile make permanent forms in which are cast the series of connected concrete T's.

It is plain, therefore, that the elimination of inert concrete material and substitution of hollow tile cuts down the dead weight of the floor construction and is the secret of the economy effected by using a long span combination of Natco Structural Clay Tile and reinforced concrete.

Our Natco One-Way system, in which the T-beams run in one direction, eliminates inert concrete more efficiently than any other of the long-span floors on the market that use hollow tile or metal cores, with the exception of the Natcoflor. When constructed of 6-in. tile spaced 4 in. apart and covered with a 2-in. concrete top, this floor has only 44 per cent of its volume in concrete, 56 per cent being hollow tile.

Design:

On the preceding pages will be found data for designing combination floors, but when the most efficient adaptation of these floors to a particular building requires a detail knowledge of their design and skill in their use, we recommend consultation with our Engineering Department—they will be glad to cooperate in every way possible with the architect or engineer in his floor designs.

Application:

Upon the request of an architect or builder, accompanied by a set of plans for the proposed building, we will apply a system of Natco combination floors most suitable to the plans and furnish a layout of our design. Approximate quantities of structural clay tile estimated from this layout will be submitted with a quotation of prices on the tile required, and information on steel reinforcement, concrete and centering will be given in such form as to enable the architect or builder to prepare an estimate of cost from his own prices on those items.

Plastering:

Plastering on ceilings formed by Natco combination floors costs considerably less per square foot than on expanded metal ceilings, because first, only two coats (instead of three) are necessary; second, considerable labor is saved because the plastering surface is flat and unyielding; third and most important of all, there is a material saving in that the plastering surface is formed automatically in building the floor slab, and on removing the forms the ceiling is ready for plastering without the installation of any expanded metal.

Temperature Stresses:

Changes in temperature from Winter to Summer will not cause cracks in Natco floor slabs, or in the plaster applied to them. Stresses due to these temperature changes are absorbed at the points where they arise and are not transmitted to accumulate at the points of anchorage at the partitions, as with expanded metal ceilings. The perfect adhesion between the concrete and the tile, bonds the two materials so strongly as to make them act as one material. When metal cores are used in place of tile, the arch formed by two adjacent T-beams has to stand by itself. In the center of this arch, which has a clear span of about 20 inches, there is only the thickness of the slab—usually about 2 or 2½ inches—to take the stresses due to expansion and contraction. It is

common practice to specify expansion bars in this slab to take care of these stresses and reinforce the arch at this weak point. On the other hand, the structural clay tile in the Natco floors support the arch and take up these stresses. The top of the arch is thicker than with metal cores by the thickness of the shell of the tile. Reinforcement in the concrete top of Natco floors is not necessary.

Theory:

T-shaped joists of reinforced concrete carry the load on the floors. The function of the tile is not only to serve as a permanent form in which the joists are cast, to fireproof the load-carrying concrete in the slab and joists, to stay the stems of the T's, to assist in taking up temperature stresses, and to furnish a good plastering surface, but also to resist with the concrete, compressive and shearing stresses in the floors. All calculations for the concrete joists which carry the load and form the structural part of the floor are based on the universal, accepted engineering practice for T-beam design, and are readily subject to analysis.

The tile in a line of units are all in contact and hold each other securely in the positions indicated on our drawings. They are not displaced by the workmen in pouring the concrete. No re-alignment is necessary. When they are covered with concrete the architect knows that they are in the positions in which he inspected them before concreting.

The naturally strong adhesive bond between tile and concrete, aided by the mechanical bond of the scoring on all Natco tile, causes the two materials to act as if they were monolithic. All concrete for floor construction should be mixed to a "quaking" consistency and the tile and concrete are so firmly united that a chisel and sledge-hammer would have to be used to separate them.

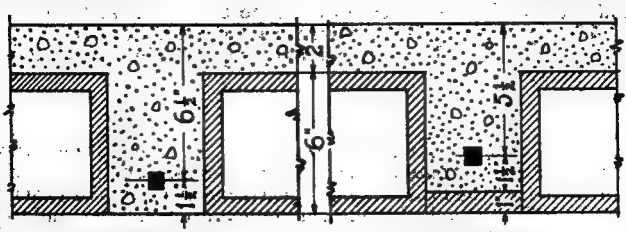
Fireproofness:

In these floors, NATCO STRUCTURAL CLAY TILE around which the concrete T-beams are cast, fireproofs the load-carrying concrete of the beams, (above the neutral axis and therefore in compression), against the flames of a fire below. In systems where metal cores are used as permanent forms around which the concrete T-beams are poured, this critical concrete in the slab has no protection from the flames. The expanded metal ceiling is all that stands between the hot flames and the critical slab-concrete; it would soon come down in a hot fire, and the heat would cause the concrete in compression to spall off the under side of the slab. As the full thickness of this slab is absolutely necessary for the strength of the floor, reduction by spalling on the under side would weaken the floor and make it imperative that it be removed and a new slab constructed. In the Natco floors the only concrete exposed to the flames is the bottom of the stems of the T-beams, which is designed only as fireproofing for the reinforcing bars. Experience with fires shows that some of this concrete spalls off where the heat is intense, but cement mortar can be plastered over these places furnishing new fireproofing for the steel. This is a simple process, but the plastering of new cement mortar on old concrete subject to compression in the slab and cast on metal cores, cannot be done, because concrete under stress must be monolithic, and new mortar cannot be made monolithic with old concrete. With Natco floors the plastering surface remains practically undamaged after a fire, and can be re-plastered readily at comparatively slight expense.

All-Tile Ceiling:

Some architects favor a ceiling with a tile surface over the entire area, for which purpose we furnish a tile slab to be laid between the structural clay tile. This is scored on both sides so as to furnish a secure bond with the concrete joist and the plaster. When the all-tile ceiling is employed, the effective depth of the floor is decreased by the thickness of the tile slab in the joist, as illustrated in the accompanying sketch, and to provide a necessary strength, the

floor thickness must be increased. It has been found that the all-tile ceiling is not essential where good construction is obtained in installing the floors.



Effective Depth 6¼"
COMBINATION CEILING

Effective Depth 5⅛"
ALL-TILE CEILING

Permanency:

Combination floors of tile and concrete are a permanent construction and, for all practical calculation, can be said to have no depreciation. There is no reason why a modern fireproof, sanitary schoolhouse, hospital or residence with floors constructed of concrete and our tile should not last and give service for hundreds of years. A home or an institutional building should be a permanent structure, built for the use of many generations, and viewed with this perspective, floors requiring expanded metal ceilings are a temporary construction.

General:

The floor construction is to be of the type known as the Natco Long-Span Floor System, as indicated for the several bays on the drawings. In general this system consists of 4-in. reinforced concrete joists running in one direction and spaced 16 in. on centers with Structural Clay Tile between them. All tile are to be covered with a 2 or 2½-in. concrete top as required, cast monolithic with the concrete joists. All floor slabs are to have 4-in. bearing on the walls.

Concrete:

All concrete used in the floor construction shall consist of 1 part portland cement, 2 parts clean sharp sand, and 4 parts broken stone or gravel of such size as will pass through a ¾-in. ring. It shall be of wet mixture and must be well tamped and worked around the reinforcing steel after pouring. The placing of concrete must be a continuous operation, and the full depth of floor must be poured at one time.

Reinforcing Steel:

Rolled deformed, or twisted bars offering a mechanical bond with the concrete satisfactory to the architect are to be used as reinforcement for the floor construction. They are to be free from mill and rust scales. No bars pitted by rust are to be used. Reinforcement is to be so placed as to allow ¾ in. of concrete between the steel and the forms.

Tile:

The depth of hollow tile fillers and the size of steel reinforcing rods are determined by the span and load to be carried and are to be of the size indicated on detail structural drawings. All tile must be wet before concrete is placed, so as to insure a good bond with the concrete. Tile shall be manufactured by National Fire Proofing Corporation, of hard burned fire clay, free from damaging impurities, and properly scored on all exterior surfaces.

Forms:

Forms must be of such size as to prevent deflection under the weight of the wet concrete, and must be provided in such quantity as to permit of speedy work. Care must be taken not to remove the forms before the concrete is set. Under long spans a center line of supports must be maintained for at least three weeks after the concrete has been poured. In cold weather the contractor must leave the forms in place until directed by the architect to remove them.

NATCO FLAT ARCH FLOORS

General:

Flat arches as adapted to floors and roofs are made up of various shaped tile as shown on Pages 317 and 318. The tile resting against the beams are called "skews" and the protection for the beam known as the "soffit" tile is held in place by the bevel on the "skews." The intermediate tile are called "inters", and the center one the "key."

Natco Flat Arch in general comes under two divisions, namely, the "End Construction Flat Arch" and the "Side Construction Flat Arch" each described and illustrated below.

The depth of the arch must be proportioned to the span between the beams and to a certain extent to the load carried. A safe general rule for finding the depth of the arch in inches is to multiply the span in feet by 1½" and add the thickness of the protection below the beams. This is the code requirement of the larger cities in general.

The outstanding advantage of the flat arch is its adaptability to speed in construction independent of temperature. Centers need remain in place but one-tenth to one-fourth as long as required under concrete construction. Moisture due to cement hydration is minimized.

Flat arch is most economical. Although the arch itself is placed by bricklayers, this labor cost is more than offset by the low centering cost. (Centering is hung. See Page 317.) There is little or no lumber loss—no nails are used. Floors beneath are accessible for work by other trades.

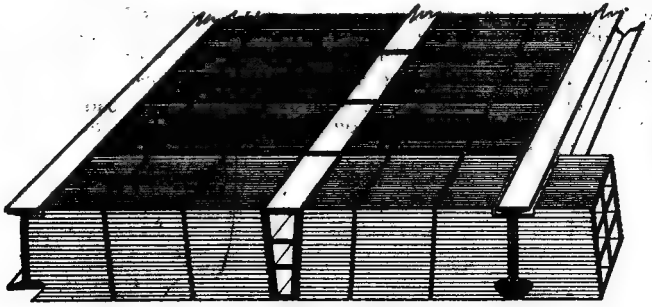
By the omission of tile units at the time of erection, pipe work of the mechanical trades is economically accommodated. Holes may be cut at any time, almost with impunity, and later easily patched.

The all-tile ceiling provides the most satisfactory surface for plastering.

Natco End Construction Flat Arch:

Natco End Construction Flat Arch consists of end construction skews and inters and side construction keys.

This arch is the most adaptable form of arch, since the end construction skew can be cut to fit different elevations and sizes of the beams. Of course, it is advisable to keep the bearing beams as near the same elevation as possible so that the same skew which is usually cut to allow a 1½" or 2" soffit of tile under the beams may be used throughout and make for uniformity and, therefore, economy of construction. Moreover, this gives a more uniform ceiling level.



Typical End Construction Arch

Natco Side and End Construction Flat Arch:

Natco Combination Side Construction Flat Arch consists of side construction skews and keys and end construction inters.

By reversing the direction of the cells in the skews, better protection is given to the sides of the beams by the mortar joints and by the shells of the skews. The inters must be set end to end in straight courses from skew to key. The typical section illustrates the method of assembling the various members of this arch.

Side construction skews, being made by die to fit the various size standard beams, cannot be changed, as can end construction skews. If it is desired to use side construction skews uniformly throughout a building, the bearing beams must be on the same level at the bottom and of sufficient depth to permit the top of the skew to go under the top flange of the beam. Of course, special conditions can be taken care of by using end construction skews at these points and cutting them to fit.

Typical Combination Side and End Construction Flat Arch

Designing Data:

The following table is applicable to all shapes of tile. Generally speaking, hollow tile of various shapes but of the same depth and cross-sectional area, have equal strength, and therefore, the strengths of arches of equal depth are directly proportional to their net sectional areas. The depth of arch as given in the table includes the protection underneath the bottom of the beam or the thickness of the soffit tile.

The strength of any arch depends as largely upon the workmanship as upon the material. The spans given in the table are safe if the arches are properly set, but may not agree with the requirements of the Building Codes of various cities.

Safe Loads given in the table have been figured for the Natco Combination Arch of side construction skews and keys with end construction inters. The net sectional areas of tile indicated, are for the keys—the critical point of the arch—and are taken per foot of tile parallel to beams.

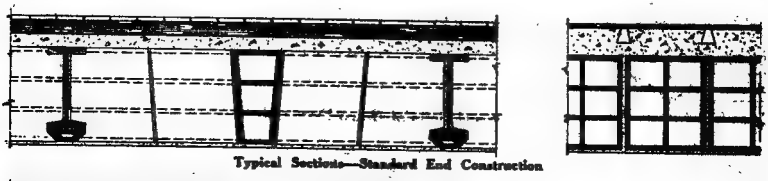
Weights of arches have not been deducted from safe loads in the table; this and other dead load must be deducted to obtain the net safe live load for any arch and span.

TABLE OF SAFE LOADS PER SQ. FT.
(Dead and Live)
Factor of Safety of 7

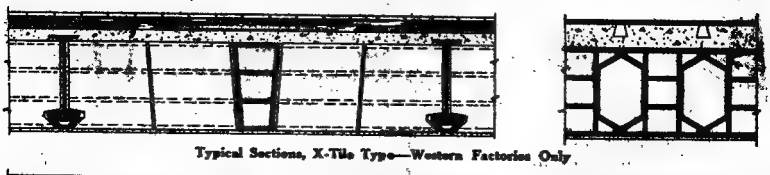
Arches	6 in.	7 in.	8 in.	9 in.	10 in.	12 in.	15 in.
Net sectional areas	27 sq. in.	27 sq. in.	27 sq. in.	27 sq. in.	36 sq. in.	36 sq. in.	36 sq. in.
Average wt. per sq. ft.	26 lb.	30 lb.	32 lb.	36 lb.	40 lb.	48 lb.	56 lb.
Span—ft. and in.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
3-0	420	480	560	630	933	1120	1400
3-3	367	417	477	537	798	964	1193
3-6	308	360	411	462	685	823	1028
3-9	263	313	358	403	597	718	896
4-0	226	276	315	354	525	630	788
4-3	.....	244	279	314	465	558	697
4-6	.....	218	248	278	415	497	622
4-9	.....	.....	223	251	372	447	558
5-0	.....	.....	201	227	336	402	504
5-3	.....	.....	182	206	305	365	457
5-6	.....	.....	.....	187	277	333	417
5-9	.....	.....	.....	171	254	306	381
6-0	.....	.....	.....	157	233	280	350
6-3	.....	.....	.....	.....	214	258	322
6-6	.....	.....	.....	.....	198	238	298
6-9	.....	.....	.....	.....	.....	221	276
7-0	.....	.....	.....	.....	.....	206	257
7-6	.....	.....	.....	.....	.....	178	223
8-0	.....	.....	.....	.....	.....	157	197
8-6	.....	.....	.....	.....	.....	.....	174
9-0	.....	.....	.....	.....	.....	.....	155
9-6	.....	.....	.....	.....	.....	.....	140
10-0	.....	.....	.....	.....	.....	.....	126

Engineering Service:

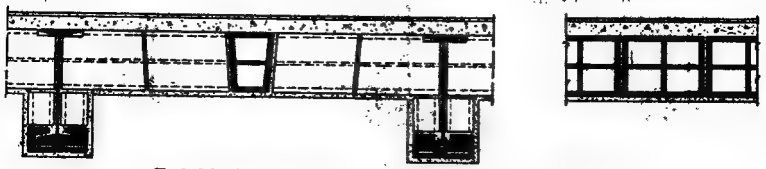
It is part of National Fireproofing Corporation's service to design the arches for each individual span and furnish schedules and sketches showing the pieces which should be used in each size of span, and to make skews which will fit the structural steel work.



Typical Sections—Standard End Construction

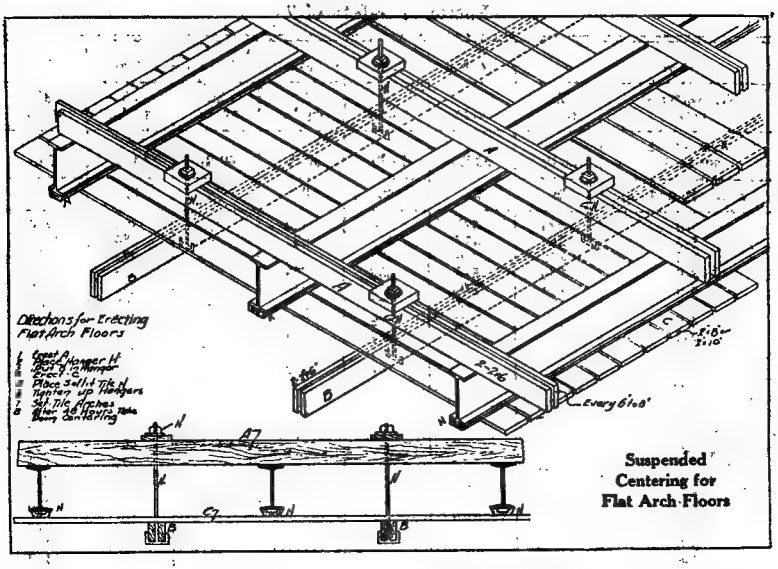


Typical Sections, X-Tile Type—Western Factories Only



Typical Sections—Raised on Floor Beams for a Paneled Ceiling Effect

NATCO FLAT ARCH FLOORS



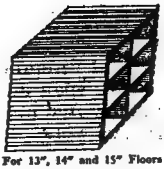
For 6" and 7" Floors

For 13", 14" and 15" Floors

Bottom Cut End Construction Skews

(*Note:* The 12" length measured at center of arch is standard)

For 8", 9", 10" and 12" Floors

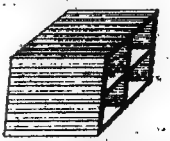


For 13", 14" and 15" Floors

Inters

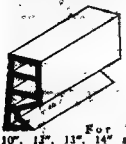
(*Note:* Furnished in 8" and 12" lengths)

For 6" and 7" Floors

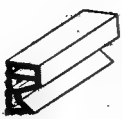


For 8", 9", 10" and 12" Flobre

Typical Units of Natco Flat Arch



For 9", 10", 12", 13", 14" and 15" Floors



For 6", 7" and 8" Floors

Soffit

(Furnished in 1¼" 2" thicknesses in widths to suit flange of beam.)

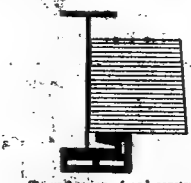
For 6", 7", and 8" Floors

For 9", 10", 12", 13", 14" and 15" Floors

Side Construction Skews

(*Note:* 4½" in thickness of centerline of arch. These skews can be furnished only for standard flange beams)

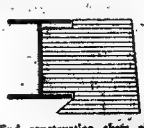
End construction skew, cut to suit clip tile and flange of beam



Shows bearing of end construction butt skew on spandrel beam

Keys

(Furnished in 3", 4", 5" and 6" thicknesses measured at the center line of arch)



End construction skew cut at top and bottom for wide flange beam

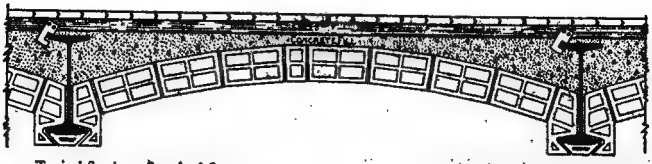
NATCO SEGMENTAL ARCH FLOORS

This form of arch combines great strength with economy and lightness. It is particularly adaptable to warehouses, lofts, factories, sidewalks, or wherever a flat ceiling is not necessary.

The 6″ arch is most commonly used and weighs approximately 35 lb. per sq. ft.

Where a very light, strong arch is required in deep beams, and a flat ceiling is also demanded, use a suspended ceiling below the beam.

The most effective location for the tie rods to counteract the thrust is near the bottom of the beams. They may be placed there and painted, or set higher and protected by the arch. If this is done the rods in the end spans should be made forked or double rods set crossing each other.



Typical Section—Standard Segmental Arch. Cinder Concrete Fill and Wood Floor in Place

Safe Loads—Natco Segmental Arch

Given for tile with the following sectional areas (per foot of arch parallel with beams): 4″ arch, 28 sq. in.; 6″, 36 sq. in.; 8″, 43 sq. in. Factor of safety, 7.

Rise in inches per foot of span. Example: Rise 1½ for 12 ft. span = 18 in.

NOTE—The weight of the arch tile has been deducted in table so that only the dead load of concrete fill, plastering, etc., must be deducted to obtain net live load.

Spans Ft. and In.	Rise In.	6-in. Arch Lb.	8-in. Arch Lb.	Spans Ft. and In.	Rise In.	6-in. Arch Lb.	8-in. Arch Lb.	Spans Ft. and In.	Rise In.	6-in. Arch Lb.	8-in. Arch Lb.
	¾	902	1078		¾	551	658		¾	386	461
	1	1184	1414		1	724	864		1	518	619
4	1¼	1485	1774	6–6	1¼	902	1077	9	1¼	645	770
	1½	1740	2079		1½	1058	1264		1½	758	906
	1¾	1986	2373		1¾	1218	1455		1¾	871	1041
	2	2233	2667		2	1358	1622		2	977	1167
	¾	792	946		¾	508	606		¾	364	435
	1	1044	1247		1	669	799		1	489	584
4–6	1¼	1313	1568	7	1¼	834	996	9–6	1¼	608	726
	1½	1539	1838		1½	981	1171		1½	721	862
	1¾	1775	2121		1¾	1127	1346		1¾	823	983
	2	1975	2359		2	1264	1510		2	923	1102
	¾	709	847		¾	471	563		¾	344	411
	1	957	1143		1	621	741		1	462	552
5	1¼	1172	1400	7–6	1¼	774	925	10	1¼	576	688
	1½	1379	1647		1½	920	1099		1½	683	816
	1¾	1592	1902		1¾	1049	1253		1¾	784	937
	2	1773	2118		2	1176	1405		2	879	1050
	¾	641	766		¾	439	525		¾	331	396
	1	864	1032		1	588	703		1	438	523
5–6	1¼	1062	1269	8	1¼	724	864	10–6	1¼	546	652
	1½	1266	1512		1½	859	1026		1½	648	774
	1¾	1439	1719		1¾	987	1179		1¾	744	889
	2	1619	1933		2	1099	1312		2	832	994
	¾	585	699		¾	411	491		¾	315	376
	1	788	941		1	551	658		1	421	503
6	1¼	969	1157	8–6	1¼	678	810	11	1¼	519	621
	1½	1154	1379		1½	806	963		1½	617	737
	1¾	1315	1570		1¾	926	1106		1¾	709	847
	2	1476	1763		2	1037	1239		2	794	948

NATCO GIRDER AND COLUMN COVERING

The purpose of beam, girder and column covering is to place a retardent to fire over the structural steel frame of buildings, and to provide a surface on which to plaster. This goes under the general name of "Fireproofing of Steel."

Natco Fireproofing Is Reliable:

It is necessary that the steel columns and the girders and beams projecting below the floor slab, be protected by at least 2" of fireproofing material. Experience has proven that well-burned structural clay tile (burned at temperature of about 2000° F.) has no equal as a covering for structural steel or iron. In case of a serious fire, the integrity of the whole structure depends upon the thorough protection of the columns and girders and floor beams, and no reasonable expense should be spared to accomplish this.

Natco Fireproofing Satisfies All Conditions:

There is a shape of Natco Girder Covering to fit in with almost any condition of fireproofing which may be required. The lower flanges of rolled beams and girders of any size have a Natco Clip or Shoe Tile to fit them. Plate girders, double beams and riveted sections are protected by means of a hung soffit and angle tile (see Figs. 4 and 8). The sides of the beams are protected by proper thickness filler tile at heights designed to fit neatly the opening between top of clip or angle tile and floor slab or top flange of beam. (See illustrations.)

If heavy plaster cornices are used, the girders are protected first by the hollow tile, and the shape required for the plastering is obtained by iron brackets and metal lath. This latter, alone, is not sufficient protection.

Natco Fireproofing Saves Dead Load:

Tile covering saves from 50 to 75% in weight over concrete or brick covering. Even on a small 12" I-beam the saving is 50% in weight; in the large girders it is much greater. (See Fig. 9.)

Natco Fireproofing Saves in Cost:

Tile fireproofing can, in general, be put in place complete for close to the same price as it costs to erect box forms about the beams for the concrete. In addition, you have the cost of steel beam wrapper and of the concrete itself to add to form cost; therefore, a saving of approximately 25 to 50% in cost, over concrete covering, can be made by use of tile.

Natco Fireproofing Promotes Speed of Erection:

No forms being needed to hold the tile in place, there is, of course, no period of waiting for concrete to set before shores and forms can be removed.

Natco Fireproofing Provides Best Plastering Surface:

One of the greatest advantages of tile beam and girder and column covering is the excellent plastering surface which is given to receive this finish.

No other surface is more economical of plaster, nor has a better mechanical key or more capillary suction than has tile. The absorption of moisture is small and test shows that the tile and plaster become almost one body. Only two coats of plaster are needed on tile.

Where steel columns are to be stiffened with concrete or where concrete columns are to be finished with plaster, the forms for same may be built out of partition tile or column covering. The tile must be banded with steel wire or strap iron, and mortar must be allowed to set, however, before the concrete is poured so that there will be sufficient strength in the wall to take care of the side pressure of the wet concrete.

Natco Fireproofing Will Carry the Load Safely:

Tile girder covering has always been used with flat arch construction of floors, but present day contractors are finding a great saving in its use with all forms of concrete and long span type of floors. Where the span is long and where there is a considerable load on the floor joists, it is customary to

use tile filler with the cells vertical, so that concrete can run into them and give a continuous solid bearing of the concrete joints on the lower flange of the beam. (See Figs. 6 and 7.) Even horizontal fillers are amply strong enough to carry the total load of the ordinary floor safely and well within the allowance for tile walls under building codes.

Natco Fireproofing Lowers Insurance Rates:

Due to the tendency of the time to lighten up in the construction of floors in order to effect saving in steel, there has come into recent use a great variety of floors of thin built-up sheet metal joists, of built-up joists of bars, and light weight structural beams with a thin slab of top concrete. These floors depend for fireproofing merely on a ceiling of plaster on metal lath.

It is self-evident that if the supporting steel beams are not protected by something other than these ceilings, fire breaking through a portion of the ceiling will get to the structural beams and the entire floor or structure will fall. Such supporting beams should be fireproofed entirely up to the underside of the concrete floor slab on top of the joists, in which case the floor slab might fail, but the structure will be intact. (See Fig. 10.)

Buildings constructed of heavy slow burning timbers and floors on a steel frame can be made much more secure and obtain a much better insurance rate if the beams and columns be encased in tile.

Natco Fireproofing a Barrier Against Corrosion:

No better protection can be found for structural steel against corrosion than tile masonry with good cement mortar filling space between tile and steel. Exterior steel members should, therefore, be built in solidly with tile masonry.

Natco Fireproofing Service:

The standard shapes entering into the construction of Natco Beam and Girder Covering are carried in stock at all times. Regardless of the size of the job, shipments can be started promptly and kept up as needed, provided, of course, that proper notice is given of the extent and nature of the requirements so that the factories can be scheduled to take care of them.

It is not necessary for the architect or contractor, when designing for or estimating on the use of Natco Structural Clay Tile Beam and Girder Covering, to worry about the sizes and shapes of the tile clips and filler which must be used on the various size beams.

It is part of the service provided by the National Fireproofing Corporation to furnish with each order for this material, a set of schedules for the architect's approval and the contractor's use, designating just what will be furnished for each beam shown on the final steel erection plans. This material is all sold on a basis of the square footage of the actual outside surface of the

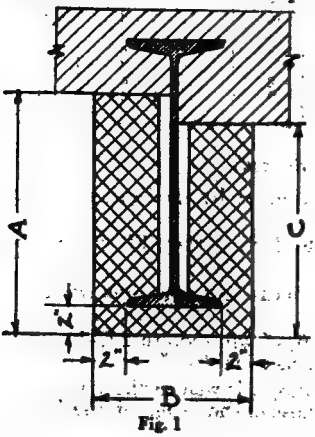


Fig. 1

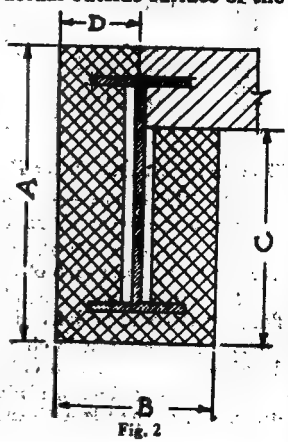


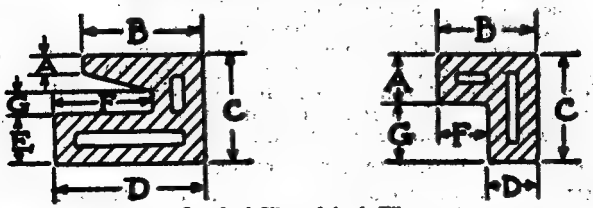
Fig. 2

tile surrounding the beam from bottom of floor on one side of beam to the bottom of floor on the other side.

Estimates can be made of the approximate amount of this tile by taking the linear distance in feet around (A+B+C) as shown in Fig. 1 or (A+B+C+D) as shown in Fig. 2, and multipying this sum by the length of the beam in feet.

After order is placed, a full set of the architectural drawings and a set of the final structural steel erection plans, as made up by the structural steel fabricator, should be forwarded to the National Fire Proofing Corporation as soon as possible, so that design can be made and submitted for approval at earliest date possible.

NATCO GIRDER COVERING



Standard Clip and Angle Tile

Note—Clips and angles are 12″ long. A percentage of halves is shipped with each order.

Die No.	Sq. ft. outside measure	Weight per piece	A	B	C	D	E	F	G
G20	.65	13	¾	3⅛	3¼	3¼	2	2	¾
G25	.70	14	⅞	3⅛	4	4⅛	2	2½	1⅛
G30	.75	15	⅞	4⅛	4¼	4⅛	2	3	⅛
G35	.80	16	⅞	4⅛	4¼	5½	2	3½	1
G40	.85	17	⅞	4⅛	4¼	6	2	4	1
G45	.90	18	⅞	4⅛	4¼	6½	2	4½	1
G48	.95	19	⅞	4⅛	4¼	6½	2	4⅝	1⅛
G50	.98	19	⅞	4⅛	4¼	7	2	5	1
G55	1.00	20	¾	4⅛	4¼	7½	2	5½	1¼
G60	1.05	21	1	5⅛	4¼	8	2	6	1⅛
G61	1.05	21	1	4½	4¼	8	2	6	1⅛
G70	1.16	23	1	6	4¼	9	2	7	1⅛
G71	1.16	23	1	4½	4¼	9	2	7	1⅛
G75	1.33	29	2	7⅛	4¼	9½	2	7½	2⅛
G80	1.40	32	2	8	4¼	10	2	8	2⅛
L23	.60	12	2	4	5	2	.....	2	3
L28	.90	18	2	4	8½	2	.....	2	6½
L43	.65	13	2	6	5	2	.....	4	3
L46	.90	18	2	6	8½	2	.....	4	6½

How to Select and Order Proper Clip Tile for Beams:

(1) Obtain the width of the beam flange, either by field measurement, or from manufacturer's handbook.

(2) Select in the above table the clip tile, having the "F" dimensions nearest to ½ the width of the flange.

(3) Order two pieces of clip tile for each linear foot of beams when the flange is covered on both sides.

Example—Beam having a flange width of 6¼″ will require a G-30, since ½ of 6¼″ is 3⅛″; and G-30 has "F" dimensions equal to 3″.

For some of the especially thick flanged beams, it is well to check the "G" dimension of the tile with the thickness of the nose of the flange of the beam.

Angle tile should be selected so that the "G" and "F" legs are long enough to cover the special condition for which it is needed.

Handling at the Job:

In handling at the job, it is well to instruct your labor foreman that when a G-20 Clip is called for, the "F" or jaw dimension is two inches, a G-25 is 2½", etc. on down the list. Similarly an L-23 is 2" at the "F" and 3" at the "G" dimension, etc. for all of the angles, except that the "G" dimension for the L-26 and L-46 angles is 6¼".

Caution—When material is received at the job, it is essential that all sizes of Clip, Angle and Filler Tile be piled in separate groups. If this be done, the handling of the shapes from pile to bricklayer will be greatly expedited.

Special Thickness of Fireproofing to Fulfill Ordinance Requirements:

Where ordinances depart from the generally accepted standards nationally established, the National Fire Proofing Corporation in all cases provides Girder and Column covering of thickness and design that fulfill the ordinance requirements in that particular locality or district. In such cases special details, comparable to those illustrated under this heading, have been prepared and are accessible at the branch office serving the locality.

Our representatives are thoroughly familiar with all local building ordinance requirements pertaining to fire proofing within their respective territories—their advice and suggestions are always promptly avialable.

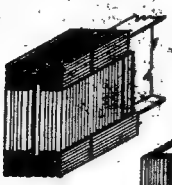


Fig. 3
Shows method of entirely enclosing a strut or beam which is in no way protected by the floor or other masonry

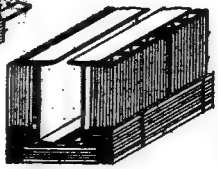


Fig. 4
Double beams, if not too far apart, may be protected on the bottom by long shoe or clip tile, however, if it be over 14" from the outside of flange on one beam to the outside of flange on the other beam, a 3" soffit tile is hung on metal hangers, which the contractor may make of No. 16 gauge or heavier strap iron. An angle tile is mortared over the end of this and after the mortar has set, the hanger serves as a reinforcement for the corner

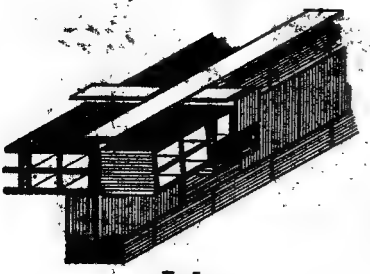


Fig. 5
Illustrates conditions of covering in flat arch work. Note especially covering where the arch is parallel to shoe on small beams and the full side covering at opening in floor

Fig. 6
Shows method of using tile fireproofing with long span concrete joist floor construction. It is economical either with structural tile or metal pan filler in the floor. You will note that the covering is put in place before the floor is poured and that the concrete of the joist fills the cells of the tile and bears directly on the flange of the beam

NATCO GIRDER AND COLUMN COVERING

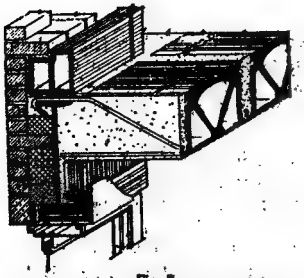


Fig. 7

At spandrel beams over window hearts and in similar places, a long clip tile can be furnished to give a good return for plastering and at the same time thoroughly fireproof the underside of the beam. Note illustration of the "Natcobar" system and of Natco Unibacker wall construction

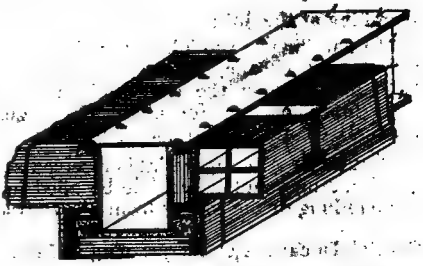


Fig. 8

Box Girders or any riveted sections are protected on soffit by hanging proper length of 3" book tile on bottom by means of steel hangers (furnished by the contractor) and covering the ends of these with long leg angle tile. This fireproofing is done before the ceiling lath are put

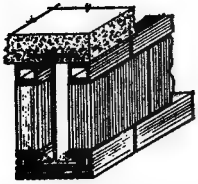


Fig. 9

Fireproofing with concrete slab floor construction. Note the extreme saving in dead load on these large girder beams due to the hollow construction. These beams are often covered after the floor is in place, thus permitting the use of the bottom flange to support floor forms

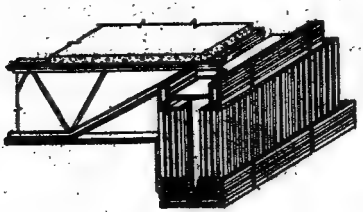


Fig. 10

The various types of light weight floors constructed of a thin slab of concrete on top of some form of light metal joist, which is protected only on under side by an ordinary coat of plaster on metal lath, are only rated as a semi-fireproof construction. We here show method of protecting the structural steel members used in connection with such construction by covering the tile entirely up to the under side of the concrete slab

Fig. 11.

Like the Hollnow Column Covering, not much of the 3" Circular Covering is carried in stock, but any normally sized order can be manufactured in a reasonable time. The radius of the tile is 10" on the outside and it is suitable for columns 16" to 28" in greatest dimension. This material is sold at a price based on the square foot of exterior surface.

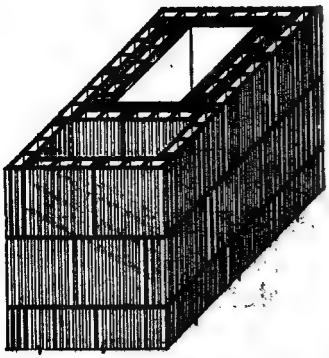


Fig. 12

Shows method of providing pipe space and vent ducts by building same in conjunction with the protection of the steel columns

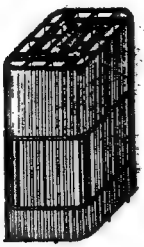


Fig. 13

Shows use of 3" Natco Hollnow Tile for encasement of corner columns. No great quantity of this tile is carried in stock, but same can be manufactured on short notice where requirements warrant

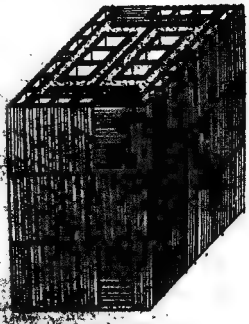
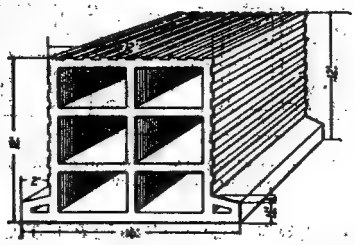


Fig. 14

Structural steel columns are most economically protected by encasing them with [illegible] of hollow tile



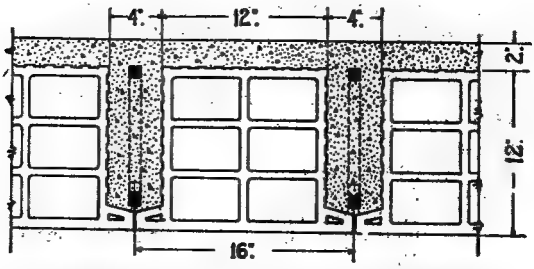
12"x16"x12" Natco Lip Tile for Roof Construction

Modern dry kiln construction demands insulation and durability in order to secure quality drying, economy of steam consumption and low maintenance. Natco Load Bearing Wall Tile and "Lip" Tile offer ideal material and are specified by leading kiln designers on account of their low absorption of moisture, their superior insulating properties and their fire proofing possibilities.

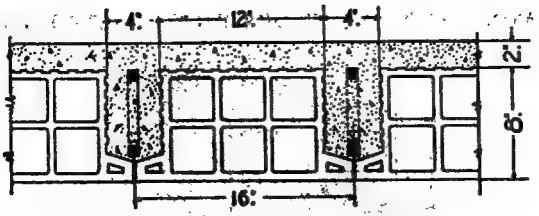
A poorly built dry kiln will leak like a sieve. The leakage may be expressed in heat units, coal or dollars.

The amount of heat lost by radiation and convection from the walls of buildings depends upon the construction of the walls and upon the condition of the outside air, which means that differences of temperature, humidity, and wind pressure, will mean variation of heat loss in a greater or lesser degree.

Therefore, the efficiency of the heating coils of a dry kiln is to some considerable extent dependent upon the material of which the kiln is constructed, and type of construction. If such material has a high thermal efficiency—or, in other words, has a great capacity of absorbing heat and radiating it into the outside atmosphere—it is obvious that, as this heat is taken from the air of kiln, it is to all intent wasted, decreasing the efficiency of the heating coils, and consequently causing waste of steam.



Typical Roof Section of 12"+2" Combination of Natco Lip Tile and Reinforced Concrete. Note the Smooth, Insulated, all-Tile Ceiling; no Cold Concrete Exposed for Condensation



Typical Section of 8"+2" Combination of Natco Lip Tile and Reinforced Concrete

DRY KILN ROOF CONSTRUCTION

Combination of "Natco" Lip Tile and Reinforced Concrete

AREA OF REINFORCING STEEL REQUIRED IN EACH CONCRETE JOIST

SPAN	8"+2" SLAB			12"+2" SLAB		
	WI 8	WI 10	WI 12	WI 8	WI 10	WI 12
10'-0"	0.22□	0.18□	0.15□	0.16□	0.13□	0.11□
11'-0.	0.27	0.21	0.18	0.20	0.16	0.13
12'-0"	0.32	0.25	0.21	0.24	0.19	0.15
13'-0.	0.37	0.30	0.25	0.28	0.22	0.18
14'-0"	0.43	0.35	0.29	0.32	0.26	0.21
15'-0"	0.50	0.40	0.33	0.37	0.30	0.24
16'-0"	0.57	0.45	0.38	0.42	0.34	0.27
17'-0"	0.64	0.51	0.43	0.47	0.38	0.31
18'-0"	0.72	0.57	0.48	0.53	0.42	0.35
19'-0"	0.80	0.64	0.53	0.59	0.47	0.39
20'-0"	0.89	0.71	0.59	0.65	0.52	0.43
21'-0"	.....	0.78	0.65	0.72	0.57	0.48
22'-0"	.....	0.85	0.71	0.79	0.63	0.53
23'-0"	.....	.....	0.78	0.86	0.69	0.58
24'-0"	.....	.....	0.85	0.94	0.75	0.63
25'-0"	.....	.....	0.92	1.02	0.81	0.68
26'-0"	.....	.....	.....	1.10	0.88	0.73
27'-0"	.....	.....	.....	1.18	0.95	0.79
28'-0"	.....	.....	.....	.....	1.02	0.85
29'-0"	.....	.....	.....	.....	1.10	0.91
30'-0"	.....	.....	.....	.....	1.18	0.98

NOTES ON DESIGN DATA—

The Table above can be used for roof slabs freely supported at both ends, when $M = WL \div 8$; semi-continuous, when $M = WL \div 10$; or continuous, when $M = WL \div 12$.

For semi-continuous and continuous spans proper reinforcement must be provided in top of slab over the supports to take care of negative bending moment. This reinforcement may consist of bent up bars or straight bars laid so as to lap over into the adjacent spans.

The above Table is based on a safe load of 40 lbs. per sq. ft. in addition to the weight of the combination slab.

Design Assumptions:

fs = 16000 lbs. per sq. in.
fc = 650 lbs. per sq. in.
v = 60 lbs. per sq. in.
u = 100 lbs. per sq. in. (Deformed Steel Bars)
r = 15

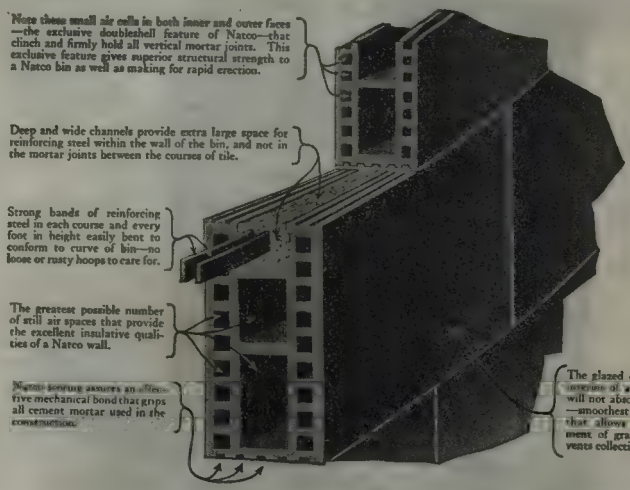
Weight of 8+2 slab is 72 lbs. per sq. ft. of floor area.
Weight of 12+2 slab is 94 lbs. per sq. ft. of floor area.
Cu. ft. of concrete required per sq. ft. of floor area = 0.293 for 8"+2".
Cu. ft. of concrete required per sq. ft. of floor area = 0.380 for 12"+2".

Natco
Storage Bins
Silos
Corn Cribs
Etc.

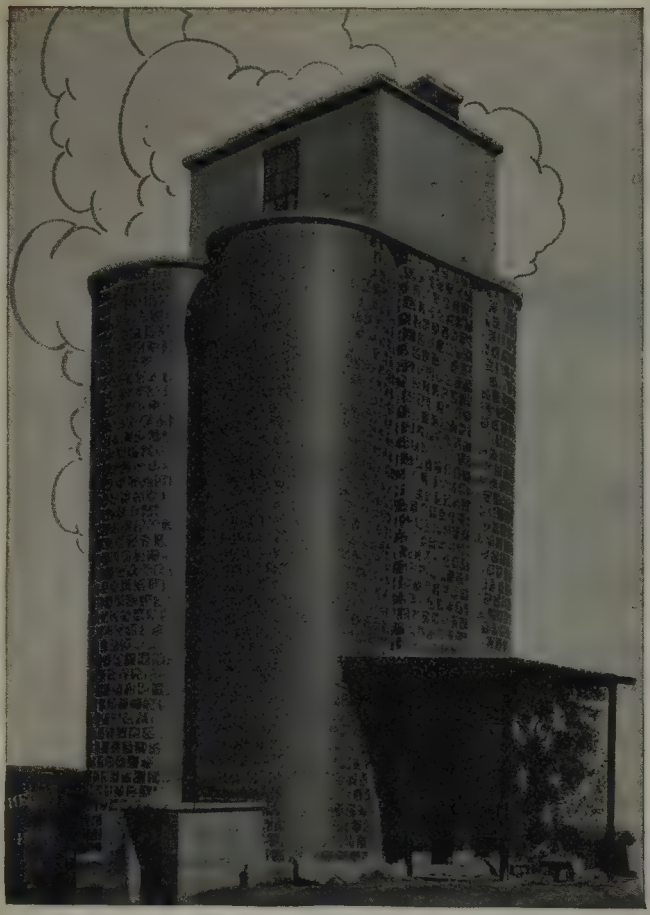
Natco
Segmentile

Natco Grain and Storage Bins

Three features—permanence, economy, and fire safety, recommend Natco tile for storage bin construction. The tile are clay, burned at a temperature of over 2000 degrees, and salt glazed. The material never depreciates, never needs painting or repairs, is unaffected by heat, cold, moisture, and chemicals, and has great reserve strength. The illustration below explains how gigantic bins can easily withstand the pressures placed upon them by contents, and by wind and other external forces.



The large channel space which permits the use of a number of steel bands for reinforcing, the amount of steel being proportioned to the pressure which is greatest at the bottom of the bin and decreases to the top, is exclusive with Natco Bin Tile.



GRAIN

Permanence—economy—fire safety—these features recommend Natco Tile Bins for grain elevators. The glazed surfaces assure the continued attractiveness of the exterior of the structure, induce the grain inside to settle unretarded, and furnish no pockets to harbor dust. The double shell construction (four walls and three dead air spaces in each tile) combined with the broken mortar joints, resists the passage of heat, cold, and moisture.

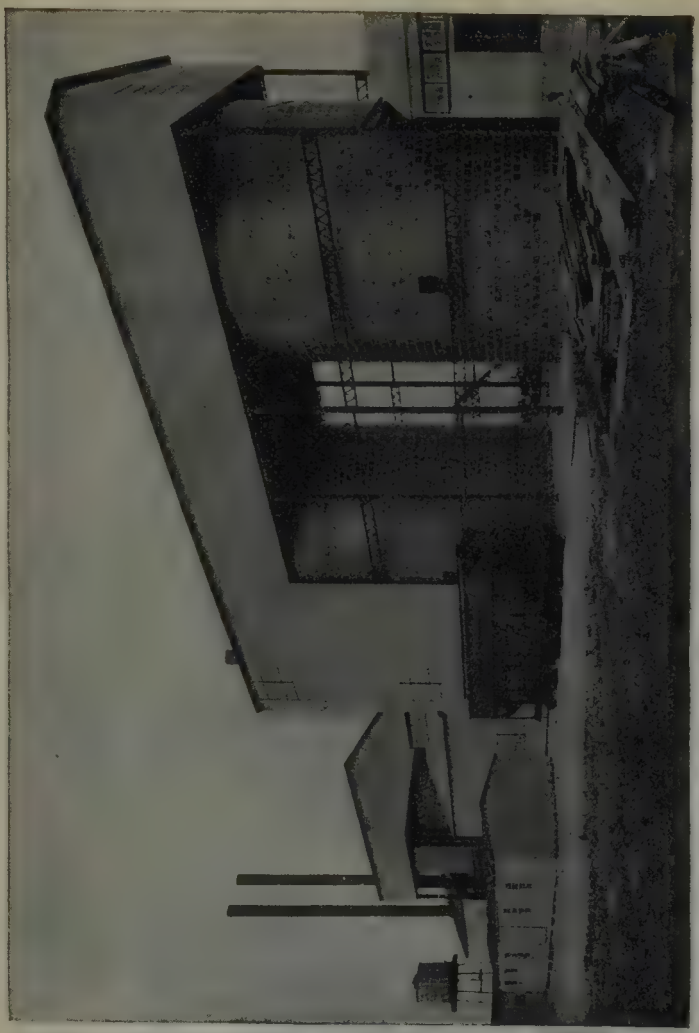
The elevator illustrated consists of four 12 x 40 foot Natco Bins, and was built by the Equity Union at St. James, Ohio. Note that the strength is not only adequate to stand the enormous grain pressure, but also to support the concrete head-house.

COAL

Whenever the yearly volume is 15,000 tons or over; the land valuation $.50 per square foot or higher; the track elevation too low to permit dumping into overhead pockets; or expansion curtailed by lack of land .. ..then the Natco Structural Clay Tile Bin is the best investment a coal dealer can make.

These bins eliminate all trouble with frozen piles, deliver dry, clean, screenable coal at all seasons, save handling, and decrease the overhead charges of the yard. And they never need painting or repairs.

The four 18 x 45 foot coal pockets illustrated are the property of Welsh Brothers, Philadelphia. Specialty Engineering Company, Engineers and Contractors.



SAND

A large amount of sand—a small amount of land. That's where a Natco Bin is a real investment. The sand is easily and economically handled. It doesn't spread all over the lot, and eat up profits in storage charges. The bin illustrated, (one for wet sand, 30 x 30 feet; two for dry sand, 30 x 40 feet; capacity 1550 tons each) were erected by H. L. McLimans for the Tavern Rock Sand Company, Menantico, New Jersey.

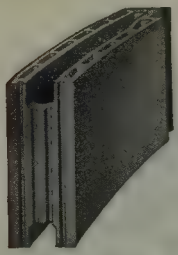
MINERAL POWDER

One hundred and twenty pounds per cubic foot is the weight of the powdered mineral (used as an abrasive in the manufacture of emery wheels and so on) stored in these bins. The two 16 x 24 foot outside bins, and (inside the building) two 12 x 16 foot bins, are the property of the American Abrasive Company, Westfield, Massachusetts.

The ability of the Natco Bins to bear this pressure is convincing testimony to their strength. Then, too, the double shell construction and the broken mortar joints retard the passage of heat, cold, and moisture, protecting the contents from depreciation, freezing, and caking.

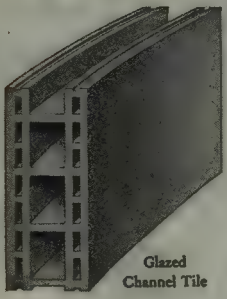
Natco Bins can be profitably utilized in many similar applications.

NATCO GLAZED TILE SILOS



Glazed
Full Jamb Tile

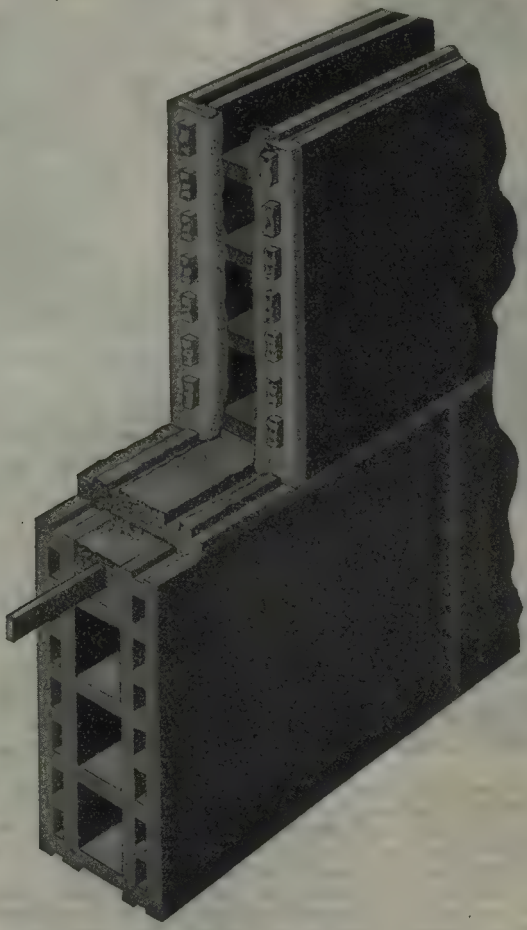
Glazed
Half Jamb Tile



Glazed
Channel Tile

The three shapes illustrated are the only tile units needed in constructing the Natco Silo. The glazed full jamb and glazed half jamb tile are used in alternate courses at the door opening, while the channel tile is used to complete the course. Reinforcing steel, embedded in mortar in the channels, give the tremendous strength for which the silos are noted.

This illustration explains the great strength and permanence of the Natco Silo. The mortar joint appears as it would if a tile had been properly set, then carefully removed. Note the wide vertical mortar joints, which key with the voids in the tile; and the way in which the steel reinforcing is imbedded in the mortar in the channel.



The large channel space which permits the use of a number of steel bands for reinforcing, the amount of steel being proportioned to the pressure which is greatest at the bottom of the silo and decreases to the top, is exclusive with Natco Silo Tile.

Points of Superiority of the Natco Silo

1 All Natco Tile are made of special clay, burned to a flint-like density that makes them strong and everlasting as rock. The inside and outside faces are glazed, giving a smooth, permanent, impervious surface.

2 In each tile there are four vertical walls. By eliminating the material in the center, you gain in lightness, without sacrificing strength.

3 Three dead air spaces in each tile provide insulation. The mortar in the vertical joints is keyed into the outside cells.

4 Dove-tail scoring on each side of the channel on the top and bottom of the tile provides a key with the horizontal joints.

5 The extra deep channel provides plenty of room for the reinforcing and the mortar in which it is firmly imbedded, and furnishes an additional key with the next course. The pull of the reinforcing comes on the tile — not on the mortar joint between the courses, as it does if the channels are shallow.

6 Four cross partitions add strength to the tile.

7 The cast iron door sill—extra heavy—never wears or splinters—provides a perfect joint with the bottom door.

8 The jamb tile forms a permanent door casing that never sags, warps, rots, or rusts. In each the cells run up and down, but the four walls and three spaces are there.

9 The jamb tile are recessed to give a deep smooth bearing for the doors. The felt strips on the doors, compressed by the silage pressure, provide an air tight seal. No metal to rust away

10 Reinforcing rods, running around the silo every course. Imbedded in mortar, they can never slip—never rust out—never need to be tightened. The Natco Silo has a steel skeleton, just like a skyscraper.

11 Steel jamb posts, which run all the way up the door opening, inside the tile, and imbedded in mortar. They securely anchor together all the courses at the door opening.

12 Tie rods, heavily galvanized, which slip over the jamb posts. They are the continuation of the steel reinforcing bands, and also serve as alternate steps.

13 Notice how the reinforcing rod, and the tie rod, are assembled on the jamb post. The steel skeleton of the silo is tied together permanently.

14 Steps—half are the tie rods, half are attached to the doors. Notice the hooks on the doors, which catch over the tie rod. All heavily galvanized.

15 The OG joint, which time has proved the best. The greater the silage pressure, the tighter it fits.

16 Doors are made of selected wood, clear and sound. Sturdy and durable. Their size makes them easy to handle.

17 Heavy galvanized rafter ties, imbedded in mortar, and fastened to the rafters with lag screws, anchoring them like a vice.

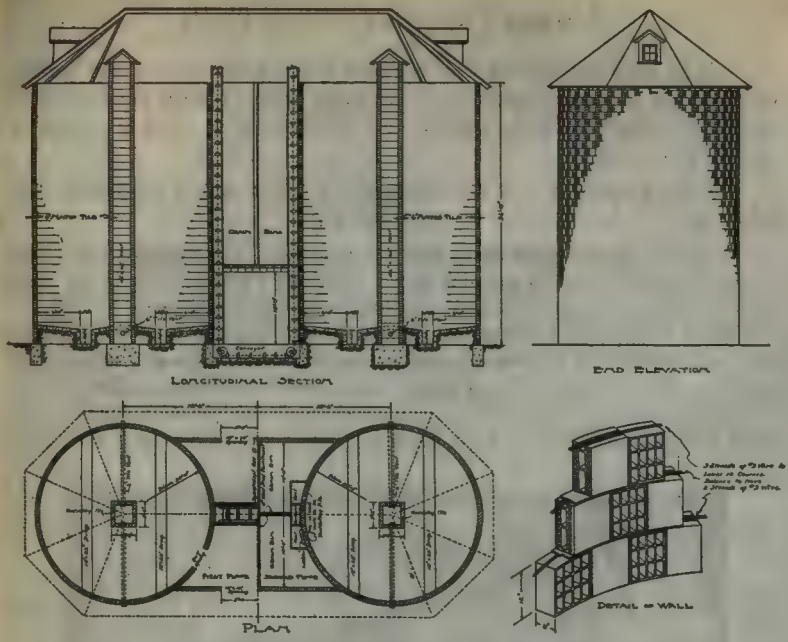
Natco Circular Corn Crib

It is no less important to store ear corn in a dry, permanent and firesafe crib that it is to provide proper storage for small grain. For the same agents of destruction from which small grain must be protected are just as damaging to ear corn.

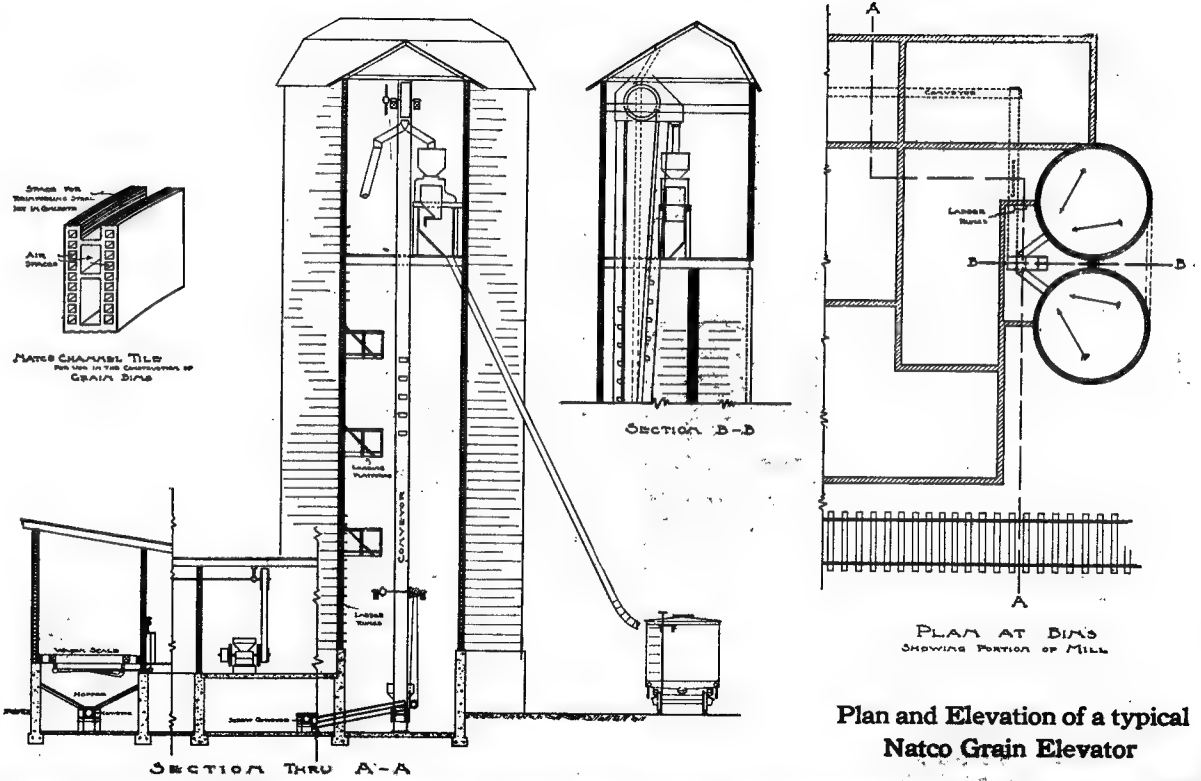
The old wooden crib is fast disappearing. It does not safeguard crop returns against rain, snow, rats, mice and fire.

More reliable and permanent types of construction are being used. The Natco Circular Crib is a popular type. A Natco Circular Crib is not only proof against rain, snow, rats and mice, but most economical because it may be erected in large sizes and securely reinforced with a minimum of reinforcing steel without the aid of tie irons and braces such as are necessary in the construction of rectangular bins of larger capacities. Better ventilation is also provided by the spacious ventilating core built in the center of each crib. The grain handling machinery for the larger sizes may also be placed in this core.

The two round cribs, 24 feet in diameter by 35 feet in height are connected by a driveway over which is a 10,000 bushel capacity Grain Bin. The cubical contents of the two cribs is 15,000 bushels of corn on the ear. Natco Glazed Bin Tile and Natco Ventilating Tile were used in building the cribs. The engine house and driveway are built of 8 x 12 x 12 Glazed Natco Double Shell Tile.



Plan and Elevations of Natco Circular Corn Crib



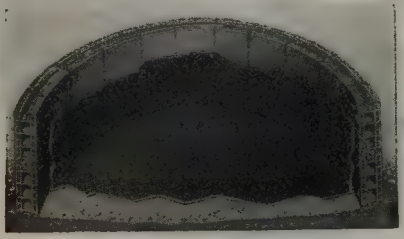
Plan and Elevation of a typical Natco Grain Elevator

NATCO SEGMENTILE

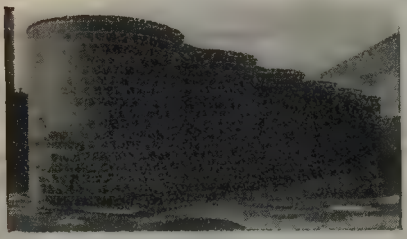
General

Natco SegmenTile is an ideal material for construction of storage bins for minerals, sand, ashes, coal and various other materials, and for insulating and protecting oil tanks.

Natco SegmenTile units are made of special clay, mined, moulded to shape, and then burned in great kilns to a temperature of over 2000 degrees. A salt glaze is applied which gives a glass-hard, glass-smooth surface, beautifully colored, that resists heat, cold, weathering, and chemical attack. This glaze never depreciates, never needs painting, looks as well after years of service as when erected.



Cross-section showing two courses SegmenTile used to protect an oil tank. Note curvature in wall. Ends are cut to any radius depending on diameter.



Battery of six tanks for hot stock, enclosed with Natco SegmenTile. Size, 16 x 18 ft.—capacity, 30,000 gals. each. Oil is kept at constant temperature of 120° F. Carnegie Refining Co., Carnegie, Pa.

Advantages

Fire Safety—Since the tile are made of an absolutely non-inflammable material, and exposed during burning to a temperature of over 2000 degrees, they are immune to flame.

Permanence—These units are permanent in character and form; will not rust, rot, warp or disintegrate.

Low Maintenance—The permanent surface glaze and everlasting body of the tile is unaffected by any agents of decay; first cost is practically the last cost.

Insulation—The double shell feature establishes in the wall a multiple blanket of dead air, which retards the passage of heat and cold, helps to keep temperatures constant.

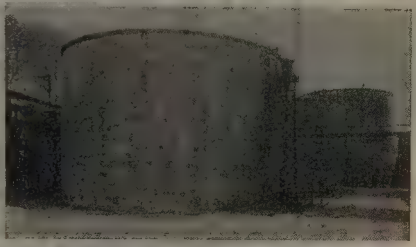
Strength—SegmenTile is a structural unit, with an extremely high crushing strength. The channel construction provides a recess into which reinforcing steel, surrounded by mortar, is placed. The strain comes on the tile, not on the mortar joint. Used in bins for holding extremely heavy materials, Natco SegmenTile has repeatedly demonstrated amazing strength.

Ease and Speed of Laying—The units are 12x12x6 in.; each one laid forms a square foot of wall, strong, fire safe, and with built-in insulation. Erection can be done by ordinary labor. The units are light enough for easy handling.

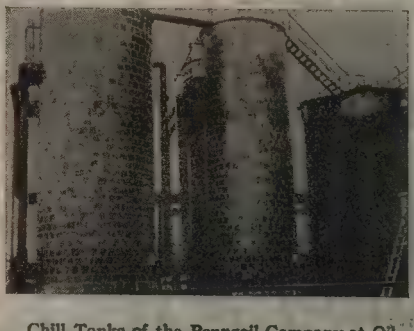
Economy—The savings effected by Natco SegmenTile start with the construction of the structure, continue throughout its life. Reasonable in first cost, the units facilitate rapid erection; and first cost is practically last cost.

Engineering Service

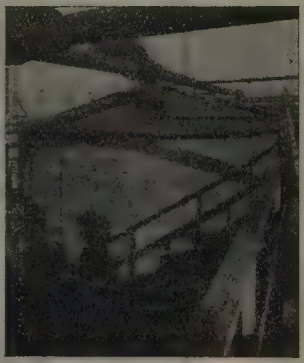
Our engineering department will gladly co-operate with you in designing SegmenTile structures for storage, insulation and protection.



The Pump House Station of the Kendall Refining Co. Tanks are completely walled in by SegmenTile, to insulate and protect them.



Chill Tanks of the Pennzoil Company at Oil City, Penna. Tanks are completely walled in by SegmenTile.



Close-up showing piping and roof construction of Chill Tanks, also Natco SegmenTile enclosure walls. Carnegie Refining Co., Carnegie, Pennsylvania.

CAPACITIES OF NATCO STORAGE BINS

Of Various Diameters—Per Foot of Height

DIAMETERS			10′ Dia.	12′ Dia.	14′ Dia.	16′ Dia.	18′ Dia.	20′ Dia.	22′ Dia.	24′ Dia.
CUBICAL CONTENTS—		Cu. Ft.	78.54	113.10	153.94	201.06	254.47	314.16	380.13	452.39
Sand, Crushed Stone, etc		Cu. Yds.	2.91	4.18	5.70	7.44	9.42	11.63	14.08	16.75
Crushed Stone or Sand	(100 lbs. per cu. ft.)	Tons	3.93	5.65	7.70	10.05	12.72	15.71	19.01	22.62
Coal—Anthracite	(52 lbs. per cu. ft.)	Tons	2.04	2.94	4.00	5.23	6.62	8.17	9.88	11.76
Coal—Bituminous	(50 lbs. per cu. ft.)	Tons	1.96	2.82	3.85	5.02	6.36	7.85	9.50	11.31
Cinders	(45 lbs. per cu. ft.)	Tons	1.77	2.54	3.46	4.52	5.72	7.07	8.55	10.18
Salt	(48 lbs. per cu. ft.)	Tons	1.88	2.71	3.69	4.82	6.11	7.54	9.12	10.86
Lime—Unslaked	(53 lbs. per cu. ft.)	Tons	2.08	3.00	4.08	5.33	6.74	8.32	10.07	11.99
Lime—Hydrated	(40 lbs. per cu. ft.)	Tons	1.57	2.62	3.08	4.02	5.09	6.28	7.60	9.05
Cement in Bulk	(94 lbs. per cu. ft.)	Tons	3.69	5.32	7.23	9.45	11.96	14.76	17.87	21.26
Grain	(1 bu. = 1.24445 cu. ft.)	Bushels	63.11	90.88	123.70	161.56	204.48	252.45	305.46	363.52
Liquid	(231 cu. in.)	Gallons	587.52	846.05	1151.55	1504.03	1903.57	2350.08	2843.57	3384.11
Interspace between 4 bins		Cu. Ft.	46.97	61.27	77.28	95.02	114.47	135.64	158.52	183.12
Interspace between 4 bins		Bushels	37.38	49.28	62.14	76.36	92.04	109.00	127.38	147.15

TO USE TABLE:—EXAMPLE:

How many tons of hard coal will a bin 20′ in diameter and 25′ high hold—From table, 8.17 x 25′ = 204 tons capacity.

NATCO GRAIN BINS

	CAPACITY IN BUSHELS OF SINGLE BINS OF VARIOUS DIAMETERS						CAPACITY OF EACH INTERSPACE BETWEEN FOUR CIRCULAR BINS					
HEIGHT	10′	12′	14′	16′	18′	20′	10′	12′	14′	16′	18′	20′
1	63	91	124	162	205	253	38	49	62	76	92	109
2	126	182	248	323	409	505	75	98	124	153	184	218
3	189	273	371	485	614	758	113	148	186	229	276	327
4	253	364	495	647	818	1010	151	197	249	305	368	436
5	315	455	619	808	1023	1263	189	246	310	382	460	545
10	631	909	1237	1616	2046	2525	377	492	621	764	920	1090
15	947	1364	1856	2424	3068	3788	566	738	932	1145	1380	1635
20	1263	1818	2475	3232	4081	5051	755	985	1242	1527	1840	2180
25	1578	2273	3094	4041	5114	6314	944	1231	1554	1909	2300	2725
30	1894	2728	3712	4849	6137	7576	1132	1477	1864	2291	2760	3270
35	2210	3182	4331	5657	7149	8839	1321	1723	2175	2673	3220	3815
40	2525	3637	4946	6465	8162	10102	1510	1969	2485	3054	3680	4360
45	2841	4091	5569	7273	9195	11364	1698	2215	2796	3436	4140	4900
50	3157	4546	6187	8081	10228	12627	1887	2462	3107	3818	4600	5450

NOTE—To find capacity of any height not given:

Add capacity of heights given in table which make total height required.

EXAMPLE:

Find capacity of four bins 16′ in diameter and 63′ high with enclosed space between them. Add capacities for height:

50′+10′+3′=(8081+1616+485)×4 Bins+(3818+764+229)=45539 bushels.

Natco
Face and Common
Brick

NATCO FACE AND COMMON BRICK

General:

Natco brick (both face and common) is produced at the company's plant at Port Murray, N. J., on the D. L. & W. R. R. about 12 miles from Easton, Pa.

They are made from a shale clay, properly burned, resulting in a brick of excellent structural qualities. They rate highly in compression and rupture tests and have a moderately low absorption. (See report of tests herewith.)

The natural market for the common brick lies in the states of New Jersey, Eastern Pennsylvania, and Southern New York, and because of its superior quality, commands a higher price than most locally made brick. It can be sold, however, in other localities upon proper representations to architects and owners who desire masonry work of a high order.

The market for Natco Face Brick is not limited to these territories although they will have an advantage because of lower freight rates, but since face brick are sold mainly on the factors of color and appearance Natco Face Brick may be sold anywhere within reason. Our face brick can and do compete with any face brick of a red color range.

Grades and Types of Brick:

NATCO COLONIALS:

Selected smooth red brick with flashed and dark brick for relief.

NATCO TEX BRICK—FULL RANGE:

A rough textured face brick in blended range of reds, browns, blues, etc.

NATCO CLINKERS:

Rough overburned brick of odd shapes, etc., in reds, browns, blues, blacks, etc., mixed indiscriminately.

NATCO K/R SMOOTH REDS (COMMON):

A smooth red brick not selected. An extra quality common brick of full size, well burned. Selection can be made in this class of brick for face brick purposes, at extra cost.

Samples of all brick will be submitted upon request. It is suggested that salesmen keep a supply of samples in their cars for distribution. Panels are available for submission to architects, and for display in dealers' offices where desirable.

Natco Clay Brick

COLUMBIA UNIVERSITY
DEPARTMENT OF CIVIL ENGINEERING
TESTING LABORATORIES
NEW YORK CITY

Machine used—400,000 Olsen

Date 4-6-28
Made for National Fireproofing Co.
Flatiron Bldg.,
Broadway & 23rd Street, New York City

REPORT OF COMPRESSION TESTS

Tested by O. Ofdahl.

Source.....National Fireproofing Co.
Material.....CLAY BRICK

Laboratory Test Number	41232	41233	41234	41235	41236
Bedded with	Cement Mortar	Cement Mortar	Cement Mortar	Cement Mortar	Cement Mortar
Length, in inches	7.90	8.05	7.98	7.92	8.05
Diameter or width, in inches	3.75	3.88	3.88	3.76	3.88
Height, in inches and Mortar	2.40	2.35	2.40	2.40	2.50
Area, in square inches	29.5	29.35	29.15	28.95	32.4
Maximum Load, in pounds	217200	343700	274600	278200	132900
Ultimate Strength, lbs. per sq. in.	7365	11710	9420	9600	4100
Average lbs. per sq. in.—8421.					

TESTING LABORATORY,
Columbia University,
New York City,
W. J. Krefeld.

Natco Clay Brick

COLUMBIA UNIVERSITY
DEPARTMENT OF CIVIL ENGINEERING
TESTING LABORATORIES
NEW YORK CITY

Machine used—10,000 Olsen

Date 3-30-28
Made for National Fireproofing Co.
Flatiron Bldg.,
Broadway & 23rd Street, New York City

REPORT OF TRANSVERSE TESTS

Tested by J. N. Kenyon.

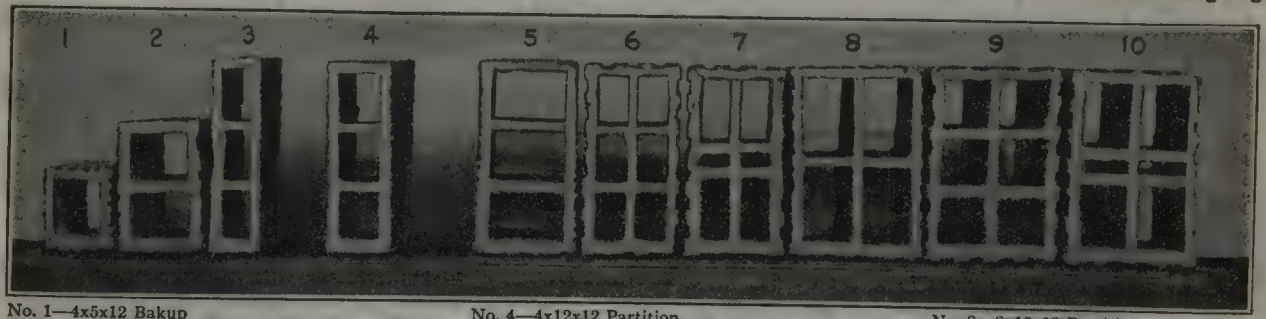
Material Tested.....CLAY BRICK

Laboratory Test Number	Mark on Test-Piece	Diameter or Width, Ins.	Thickness or Height, Ins.	Distance Between Support, Ins.	Maximum Load, Lbs.	Modulus of Rupture lbs. per Sq. in.	Average
41227	1	3.48	2.30	7	2369	1358	.....
41228	2	3.86	2.22	7	1889	1125	.....
41229	3	3.88	2.35	7	1129	802	1115
41230	4	3.60	2.25	7	2589	1482	.....
41231	5	3.85	2.20	7	1709	1009	.....

TESTING LABORATORY,
New York City,
W. J. Krefeld.

Natco
Test Data

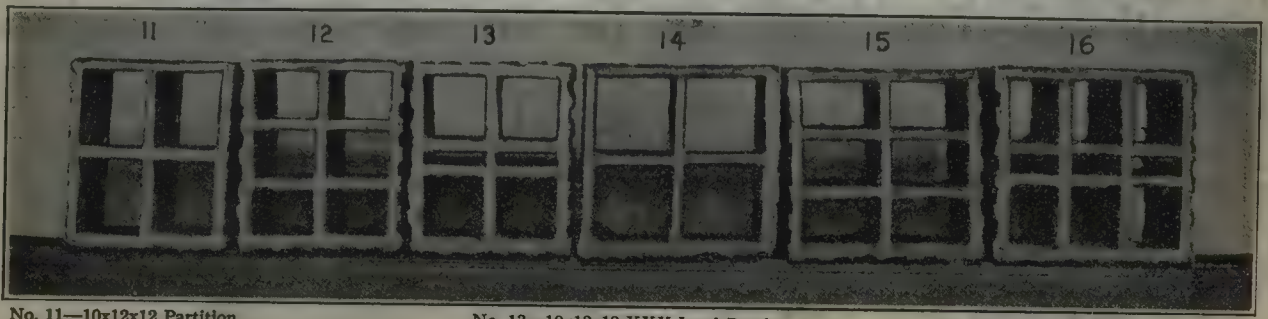
Illustrations Showing Natco Structural Clay Building Tile As Tested At The U. S. Bureau of Standards (Test Data on Following Pages)



No. 1—4x5x12 Bakup
No. 2—8x5x12 Bakup
No. 3—3x12x12 Partition

No. 4—4x12x12 Partition
No. 5—6x12x12 Partition
No. 6—6x12x12 XX Load Bearing
No. 7—6x12x12 XXX Load Bearing

No. 8—8x12x12 Partition
No. 9—8x12x12 XX Load Bearing
No. 10—8x12x12 XXX Load Bearing



No. 11—10x12x12 Partition
No. 12—10x12x12 XX Load Bearing

No. 13—10x12x12 XXX Load Bearing
No. 14—12x12x12 Partition

No. 15—12x12x12 XX Load Bearing
No. 16—12x12x12 XXX Load Bearing

EXTRACT FROM U. S. BUREAU OF STANDARDS TECHNOLOGIC PAPER No. 120

TABLE 1.—COMPRESSION TESTS OF STRUCTURAL CLAY TILE

Size of tile (See illustrations on page 501)	How tested	Gross section area, in square inches	Net section area, in square inches	Load at incipient failure, in pounds per sq. in. of net area	Maximum load: Pounds	Maximum load: Pounds per square inch of net area	Maximum load: Pounds per square inch of gross area
Bakup:							
4 by 8 by 12 inches.....	End...	20	10.11	5500	75,825	7500	3,790
Illustration No. 1	Do...	do	9.86	6500	74,850	7500	3,740
	Do...	do	9.77	6000	68,390	7000	3,420
Average.....				6000	73,020	7330	3,630
	Edge...	48	15.37	2600	89,000	4490	1,440
	Do...	do	15.37	.....	76,700	4990	1,600
	Do...	do	15.25	2500	91,500	6000	1,910
Average.....				2250	79,070	5160	1,650
	Flat....	60	14.16	7000	102,350	7230	1,710
	Do...	do	14.00	7000	104,800	7490	1,750
	Do...	do	14.04	.....	125,640	8950	2,090
Average.....				7000	110,930	7890	1,850
Bakup:							
5 by 8 by 12 inches.....	End....	40	16.79	4800	123,420	7350	3,090
Illustration No. 2	Do...	do	16.79	5500	100,740	6000	2,520
	Do...	do	16.79	5000	104,380	6220	2,610
Average.....				5800	109,510	6520	2,740
	Edge...	60	13.55	2500	65,400	4826	1,090
	Do...	do	14.52	2400	85,850	5910	1,430
	Do...	do	13.55	1540	79,800	5890	1,330
Average.....				2180	77,020	5540	1,280
	Flat....	96	23.00	.....	135,000	5850	1,410
	Do...	do	22.25	.....	128,000	5780	1,330
	Do...	do	23.30	.....	143,350	6150	1,490
Average.....				.....	135,450	5930	1,410
Partition:							
3 by 12 by 12 inches....	End....	36	16.02	3000	80,580	5030	2,240
Illustration No. 3	Do .	do	16.24	2500	74,000	4560	2,060
	Do...	do	14.99	3500	74,950	5000	2,080
Average.....				3000	76,510	4960	2,130
	Edge...	36	10.32	3000	65,500	6350	1,820
	Do...	do	10.32	2420	64,050	6210	1,780
	Do...	do	11.16	2150	41,500	3720	1,150
Average.....				2520	57,020	5430	1,580
	Flat..	144	21.53	.....	137,400	6380	950
	Do...	do	21.99	.....	152,100	6920	1,060
	Do...	do	21.09	.....	128,300	6080	890
Average.....				.....	139,270	6460	970
Partition:							
4 by 12 by 12 inches....	End....	48	19.44	.....	106,920	5500	2,230
Illustration No. 4	Do...	do	18.79	3500	135,260	7200	2,820
	Do...	do	20.70	3000	154,700	7470	3,220
Average.....				3250	132,290	6720	2,760
	Edge...	48	12.47	1120	47,000	3770	980
	Do...	do	12.24	1230	67,530	5520	1,410
	Do .	do	12.47	1450	61,650	4940	1,280
Average.....				1270	58,730	4740	1,220
	Flat..	144	21.84	.....	170,130	7790	1,180
	Do .	do	23.08	.....	112,030	4860	780
	Do...	do	23.28	.....	146,020	6280	1,010
Average.....				.....	142,730	6310	990

See page 501 for illustrations of tile tested

COMPRESSION TESTS OF STRUCTURAL CLAY TILE—Continued

Size of tile (See illustrations on page 501)	How tested	Gross section area in square inches	Net section area, in square inches	Load at incipient failure, in pounds per sq. in. of net area	Maximum load		
					Pounds	Pounds per square inch of net area	Pounds per square inch of gross section area
Partition:							
6 by 12 by 12 inches....	End....	72	22.80	6000	181,080	7940	2,520
Illustration No. 5	Do...	do	24.90	5000	170,000	6830	2,360
	Do...	do	25.56	6000	168,140	6500	2,310
Average.....				5670	172,410	7090	2,390
	Edge...	72	13.58	4000	66,770	4920	930
	Do...	do	12.12	.....	66,680	5500	930
	Do...	do	13.06	3830	55,040	4210	760
Average.....				3920	62,830	4880	870
	Flat....	144	23.86	.....	181,340	7600	1,260
	Do...	do	23.96	.....	218,650	9130	1,520
	Do...	do	24.62	.....	185,300	7530	1,290
Average.....				.....	195,100	8090	1,360
XX Load Bearing:							
6 by 12 by 12 inches....	End....	72	28.63	6500	306,180	10,300	4,240
Illustration No. 6	Do...	do	31.32	8800	291,340	9300	4,050
	Do...	do	30.03	9500	321,880	10,700	4,420
Average.....				8270	306,130	10,100	4,250
	Edge...	72	19.34	3500	115,530	5970	1,600
	Do...	do	18.75	3500	120,300	6420	1,670
	Do...	do	19.06	3000	130,860	6860	1,820
Average.....				3330	122,230	6420	1,700
	Flat....	144	25.38	3300	201,820	7950	1,400
	Do...	do	26.11	2300	170,080	6510	1,180
	Do...	do	25.85	2320	158,660	6130	1,100
Average.....				2640	176,850	6860	1,230
XXX Load Bearing:							
6 by 12 by 12 inches....	End....	72	33.78	5500	310,300	9190	4,310
Illustration No. 7	Do...	do	33.46	6000	413,540	12,360	5,740
	Do...	do	33.55	6500	319,100	9510	4,430
Average.....				6000	347,650	10,350	4,830
	Edge...	72	22.13	3000	142,900	6460	1,980
	Do...	do	22.32	3500	145,860	6540	2,030
	Do...	do	21.69	1800	128,780	5930	1,790
Average.....				2870	139,150	6310	1,930
	Flat....	144	29.87	.....	188,320	6040	1,250
	Do...	do	29.09	1030	151,180	5200	1,050
	Do...	do	30.45	920	147,500	4840	1,020
Average.....				975	158,330	5360	1,090
Partition:							
8 by 12 by 12 inches....	End....	96	26.92	.....	241,400	8970	2,510
Illustration No. 8	Do...	do	27.46	3500	211,920	7720	2,210
	Do...	do	27.61	6500	208,200	7540	2,170
Average.....				5000	220,510	8080	2,300
	Edge...	96	12.19	3940	58,180	4610	590
	Do...	do	11.28	4170	64,300	5710	670
	Do...	do	12.00	2000	48,410	4030	500
Average.....				3370	56,300	4780	590
	Flat....	144	23.66	.....	201,340	8510	1,400
	Do...	do	22.93	.....	192,200	8382	1,330
	Do...	do	23.34	.....	217,500	9320	1,510
Average.....				.....	203,690	8740	1,410

See page 501 for illustrations of tile tested

COMPRESSION TESTS OF STRUCTURAL CLAY TILE—Continued

Size of tile (See illustrations on page 501)	How tested	Gross section area in square inches	Net section area, in square inches	Load at incipient failure, in pounds per sq. in. of net area	Maximum load		
					Pounds	Pounds per square inch of net area	Pounds per square inch of gross section area
XX Load Bearing:							
9 by 12 by 12 inches....	End....	96	37.49	2000	272,920	7280	2,840
Illustration No. 9	Do...	do	39.54	4000	251,340	6360	2,620
	Do...	do	44.52	.....	240,240	5400	2,500
Average.....				3000	254,630	6350	2,650
	Edge...	96	29.73	2000	112,540	5430	1,170
	Do...	do	20.27	1500	85,250	4210	890
	Do...	do	19.74	.....	99,360	5030	1,040
Average.....				1750	99,050	4890	1,030
	Flat....	144	27.76	.....	177,000	6378	1,230
	Do...	do	27.56	3060	173,800	6310	1,210
	Do...	do	28.41	.....	147,640	5200	1,230
Average.....				3060	166,150	5960	1,150
XXX Load Bearing:							
8 by 12 by 12 inches....	End....	96	40.22	3250	211,390	5260	2,200
Illustration No. 10	Do...	do	42.06	.....	270,860	6440	2,820
	Do...	do	41.82	.....	201,700	4820	2,100
Average.....				3250	227,980	5510	2,370
	Edge...	96	20.99	.....	123,380	5880	1,290
	Do...	do	21.59	.....	88,380	4000	900
	Do...	do	21.16	.....	108,790	5140	1,130
Average.....				.....	106,180	5010	1,110
	Flat....	144	31.03	2000	143,850	4635	1,000
	Do...	do	30.20	1960	124,940	4137	870
	Do...	do	30.39	3900	157,520	5183	1,090
Average.....				2599	142,100	4650	990
Partition:							
10 by 12 by 12 inches...	End....	120	39.00	.....	193,600	4960	1,610
Illustration No. 11	Do...	do	37.36	.....	281,630	7540	2,350
	Do...	do	37.82	3500	287,800	7610	2,400
Average.....				3500	254,340	6700	2,120
	Edge...	120	20.76	.....	108,100	5210	900
	Do...	do	20.47	3960	98,340	4800	820
	Do...	do	20.67	3000	129,780	6310	1,080
Average.....				3480	112,410	5440	940
	Flat....	144	21.55	.....	92,310	4280	640
	Do...	do	21.53	2500	88,860	4130	620
	Do...	do	21.20	.....	74,450	3510	520
Average.....				2500	85,210	3970	590
XX Load Bearing:							
10 by 12 by 12 inches...	End....	120	41.98	3500	279,140	6650	2,330
Illustration No. 12	Do...	do	43.00	4500	379,500	8830	3,160
	Do...	do	42.76	3500	389,840	9120	3,250
Average.....				3830	349,490	8200	2,910
	Edge...	120	20.69	3000	178,820	8640	1,490
	Do...	do	20.57	1500	159,480	7750	1,330
	Do...	do	20.79	5000	148,700	7150	1,240
Average.....				3170	162,330	7850	1,350
	Flat....	144	28.48	4500	131,450	4620	910
	Do...	do	25.66	7200	186,400	7260	1,290
	Do...	do	26.00	2500	141,200	5430	980
Average.....				4730	153,020	5770	1,060

See page 501 for illustrations of tile tested

COMPRESSION TESTS OF STRUCTURAL CLAY TILE—Continued

Size of tile (See Illustrations on page 501)	How tested	Gross section area in square inches	Net section area, in square inches	Load at incipient failure, in pounds per square inch of net area	Maximum load		
					Pounds	Pounds per square inch of net area	Pounds per square inch of gross section area
XXX Load Bearing:							
10 by 12 by 12 inches...	End....	120	46.38	4500	407,860	8792	3,400
Illustration No. 13	Do...	do	46.60	6500	407,440	8382	3,400
	Do...	do	48.17	.....	419,040	8706	3,440
	Average	.....	.....	5500	411,450	8630	3,430
	Edge...	120	22.67	.....	128,440	5614	1,070
	Do...	do	22.81	3500	127,920	5607	1,070
	Do...	do	23.58	.....	127,240	5394	1,060
	Average.....	.....	.....	3500	127,870	5540	1,070
	Flat....	144	30.06	2000	133,900	4330	930
	Do...	do	30.19	2000	144,420	4780	1,000
	Do...	do	30.23	1500	131,060	4340	910
	Average.....	.....	.....	1830	136,460	4480	950
Partition:							
12 by 12 by 12 inches...	End....	144	45.10	5000	277,520	6153	1,930
Illustration No. 14	Do...	do	47.38	6000	348,000	7350	2,420
	Do...	do	42.52	5200	303,200	7130	2,110
	Average..... ...	.....	.....	5400	309,570	6880	2,150
	Edge...	144	22.26	2500	115,800	5202	800
	Do...	do	22.68	3500	122,580	5402	850
	Do...	do	22.59	1500	105,020	4649	730
	Average.....	.....	.....	2500	114,470	5080	790
XX Load Bearing:							
12 by 12 by 12 inches...	End....	144	47.91	5500	334,440	6980	2,320
Illustration No. 15	Do...	do	47.25	3500	318,450	6740	2,210
	Do...	do	45.78	4500	329,960	7206	22,90
	Average.....	.....	.....	4500	327,620	6980	2,280
	Edge ..	144	21.69	2500	106,950	4932	740
	Do...	do	22.09	1500	96,660	4376	620
	Do...	do	22.03	.....	100,000	4540	690
	Average.....	.....	.....	2000	101,200	4620	700
	Flat....	144	28.44	.....	126,300	4442	880
	Do...	do	27.96	2500	99,690	3565	690
	Do...	do	27.84	.....	133,980	4848	930
	Average.....	.....	.....	2500	119,990	4280	830
XXX Load Bearing:							
12 by 12 by 12 inches...	End....	144	55.69	5500	353,220	6342	2,450
Illustration No. 16	Do	do	55.30	2000	312,500	5650	2,170
	Do...	do	55.64	3500	296,200	5324	2,060
	Average.....	.....	.....	3670	320,640	5770	2,230
	Edge...	144	30.91	3400	119,620	3870	830
	Do...	do	30.27	2400	135,700	4483	940
	Do...	do	28.18	2000	146,190	5188	1,020
	Average.....	.....	.....	2600	133,840	4510	930
	Flat....	144	28.30	4000	126,550	4472	880
	Do...	do	29.97	1670	104,315	3481	720
	Do...	do	29.37	2200	146,500	4988	1,020
	Average.....	...	.....	2820	125,790	4310	820
	Flat*	.....	.....	.....	.....	.....	.....

*Same as on edge.

See page 501 for illustrations of tile tested

SUMMARY OF TESTS ON HOLLOW-TILE WALLS.

[The walls were 4 feet long and 12 feet high.]

SERIES I.—LOAD CONCENTRIC. JOINTS BROKEN.

Reprinted from U. S. Bureau of Standard's Technologic Paper No. 238

Wall No.	Age of wall.	Size of wall tile (inches).	Direction of cells.	Net sectional area of wall.	Ultimate strength.				Strength.		Modulus of elasticity net area.	Maximum deflection at center.	Ratio of wall properties to tile properties.		
					Pounds	Tons per lin. ft.	Gross area.	Net area.	At first crack.				Ultimate strength.	At first crack.	Modulus of elasticity.
									Pounds.	Net area.					
	Days.			Sq. in.			Lbs./in.²	Lbs./in.²		Lbs./in.²	Lbs./in.²	Inch.	Per cent.	Per cent.	Per cent.
1	31	12 by 12 by 12..	Vertical....	240	485,000	60.0	833	2,020	390,000	1,625	2,500,000	0.02			
2	30	.....do.....	....do.....	240	592,000	73.3	1,017	2,470	390,000	1,625	1,250,000	.03			
3	30	.....do.....	....do.....	240	553,000	68.4	950	2,300	510,000	2,125	2,150,000	.02			
		Average.....	.....	240	543,000	67.2	933	2,260	430,000	1,790	1,970,000	.....	32.6	34.6	54.5
4	32	8 by 12 by 12...	Vertical....	134	256,000	31.7	880	1,910	120,600	900	1,400,000	.00			
5	29	.....do.....	....do.....	134	308,000	38.1	1,058	2,300	120,600	900	2,040,000	.01			
6	30	.....do.....	....do.....	134	328,800	40.7	1,129	2,450	134,000	1,000	1,000,000	.15			
		Average.....	.....	134	297,500	36.8	1,022	2,220	125,100	930	1,480,000	.....	26.0	17.4	35.8
7	31	8 by 12 by 12...	Vertical....	177	398,800	49.4	1,027	2,250	194,700	1,100	2,660,000	.06			
8	30	.....do.....	....do.....	177	358,400	43.9	914	2,025	177,000	1,000	1,390,000	.21			
9	31	.....do.....	....do.....	177	468,200	57.4	1,195	2,645	159,300	900	3,880,000	.01			
		Average.....	.....	177	408,500	50.2	1,045	2,310	177,000	1,000	2,640,000	.....	48.0	23.2	55.0
					SERIES II.—LOAD CONCENTRIC. JOINTS BROKEN.										
10	29	12 by 12 by 12..	Horizontal..	132.5	295,000	36.0	499	2,230	84,800	640	2,320,000	0.01			
11	31	.....do.....	....do.....	132.5	200,000	24.4	338	1,510	42,400	320	3,760,000	.00			
12	31	.....do.....	....do.....	132.5	170,000	20.7	288	1,280	42,400	320	3,470,000	.00			
		Average.....	.....	132.5	221,700	27.0	375	1,670	56,530	430	3,180,000	.....	44.1	16.8	.....
13	29	8 by 12 by 12...	Horizontal..	86.5	116,000	14.1	293	1,340	32,000	370	3,550,000	.00			
14	31	.....do.....	....do.....	86.5	180,000	22.0	457	2,080	48,000	550	3,390,000	.00			
15	31	.....do.....	....do.....	86.5	170,000	20.6	429	1,965	32,000	370	4,380,000	.00			
		Average.....	.....	86.5	155,300	18.9	393	1,795	37,300	430	3,770,000	.....	32.9	9.5	.....
16	30	6 by 12 by 12...	Horizontal..	80	176,000	21.6	599	2,200	32,000	400	.....	0.00			
17	30	.....do.....	....do.....	80	220,000	26.8	745	2,750	32,000	400	3,250,000	.03			
18	30	.....do.....	....do.....	80	221,000	27.0	748	2,760	32,000	400	4,060,000	.06			
		Average.....	.....	80	205,600	25.1	697	2,570	32,000	400	3,625,000	.....	43.5	16.1	.....
					SERIES III.—LOAD ECCENTRIC. JOINTS BROKEN.										
19	277	12 by 12 by 12..	Horizontal..	132.5	118,500	14.6	203	900	25,000	190	.....	0.02	23.8	7.4	.....
20	75	.....do.....	Vertical....	240	323,000	39.4	547	1,345	200,000	835	.....	.04	19.4	16.2	.....
21	65	6 by 12 by 12...	....do.....	134	210,000	25.9	718	1,570	110,000	820	.....	.04	18.5	15.4	.....
22	74	.....do.....	Horizontal..	80	102,000	12.4	345	1,275	24,000	300	.....	.02	21.5	12.1	.....
23	31	8 by 12 by 12...	Vertical....	177	200,000	24.5	510	1,130	24,000	135	.....	.09	22.6	3.1	.....
24	29	.....do.....	Horizontal..	86.5	51,000	6.2	129	590	48,000	550	.....	.03	10.8	12.1	.....
					SERIES IV.—LOAD CONCENTRIC. JOINTS BROKEN.										
25	28	12 by 12 by 12..	Vertical....	256	585,000	70.2	975	2,285	128,000	500	2,210,000	0.01			
26	28	.....do.....	....do.....	256	525,000	64.0	888	2,050	128,000	500	2,200,000	.02			
		Average.....	.....	256	555,000	67.1	931	2,167	128,000	500	2,205,000	.....	57.6	27.3	94.8
27	28	8 by 12 by 12...	Vertical....	152	200,000	23.5	654	1,320	30,400	200	2,160,000	.01			
28	28	.....do.....	....do.....	152	222,000	26.2	730	1,460	30,400	200	1,740,000	.06			
		Average.....	.....	152	211,000	24.8	692	1,390	30,400	200	1,950,000	.....	38.5	9.6	48.1
					SERIES V.—LOAD CONCENTRIC. JOINTS BROKEN.										
29	28	6 by 12 by 12...	Horizontal..	90	106,000	12.7	353	1,180	38,000	400	1,430,000	0.05			
30	28	.....do.....	....do.....	90	122,000	14.5	403	1,360	63,000	700	.....	.00			
		Average.....	.....	90	114,000	13.6	378	1,270	49,500	550	.....	.....	68.0	44.4	.....
					SERIES VI.—LOAD CONCENTRIC. JOINTS NOT BROKEN.										
31	30	12 by 12 by 12..	Vertical....	256	371,000	44.7	622	1,450	76,800	300	1,652,000	0.01	38.5	34.3	47.3
32	30	.....do.....	Horizontal..	136	181,000	21.6	300	1,330	84,800	620	1,586,000	.01	64.0	71.0	45.3

SUMMARY OF TESTS ON HOLLOW-TILE WALLS.

(Three walls were 4 feet long and 12 feet high.)

SERIES I.—LONG CENTRIC JOINTS BROKEN.

Reported from U. S. Bureau of Standards's Technologic Paper No. 250

Wall No.	Age of wall.	Size of wall tile (inches).	Direction of cells.	Net area of wall.	Ultimate strength.			Strength.		Modulus of elasticity per sq. in.	Maximum deflection at center.	Ratio of wall properties to tile properties.		
					Pounds.	Tons per lin. ft.	Gross area.	At first crack.	At first crack.			Ultimate strength.	At first crack.	Modulus of elasticity.
								Pounds.	Net area.					
1	Days.	12 by 12 by 12	Vertical	Sq. in. 240	488,000	80.0	Lbs. per sq. in. 2,000	380,000	Lbs. per sq. in. 1,583	Lbs. per sq. in. 2,166,000	Inch. 0.02	Per cent.	Per cent.	Per cent.
2	30	do	do	240	488,000	80.0	2,033	380,000	1,583	2,166,000	.03			
3	40	do	do	240	532,000	88.4	2,217	380,000	1,583	2,166,000	.02			
		Average		240	502,667	82.7	2,094	380,000	1,583	2,166,000		32.8	34.9	64.5
4	32	8 by 12 by 12	Vertical	124	260,000	86.7	2,097	190,000	1,534	1,455,000	0.00			
5	30	do	do	124	260,000	86.7	2,097	190,000	1,534	2,000,000	.01			
6	30	do	do	124	258,000	86.7	2,081	190,000	1,534	1,666,000	.15			
		Average		124	259,667	86.7	2,092	190,000	1,534	1,707,000		28.0	17.4	72.5
7	31	8 by 12 by 12	Vertical	77	150,000	50.0	1,948	85,000	1,105	1,000,000	.05			
8	30	do	do	77	140,000	46.2	1,818	85,000	1,105	1,000,000	.01			
9	31	do	do	77	150,000	50.4	1,948	150,000	940	2,000,000	.01			
		Average		77	146,667	49.2	1,905	140,000	1,000	1,333,000		48.0	22.9	85.0

SERIES II.—LONG CONCENTRIC JOINTS BROKEN.

10	29	12 by 12 by 12	Horizontal	240	470,000	78.3	1,958	260,000	1,083	2,000,000	0.01			
11	31	do	do	240	470,000	78.3	1,958	260,000	1,083	2,000,000	.01			
12	31	do	do	240	470,000	78.3	1,958	260,000	1,083	2,000,000	.01			
		Average		240	470,000	78.3	1,958	260,000	1,083	2,000,000		48.0	34.1	72.9
13	29	8 by 12 by 12	Horizontal	80	150,000	50.0	1,875	85,000	1,063	1,000,000	.02			
14	31	do	do	80	150,000	50.0	1,875	85,000	1,063	1,000,000	.04			
15	31	do	do	80	150,000	50.0	1,875	85,000	1,063	1,000,000	.00			
		Average		80	150,000	50.0	1,875	85,000	1,063	1,000,000		48.0	32.9	72.9
16	30	8 by 12 by 12	Horizontal	80	150,000	50.0	1,875	85,000	1,063	1,000,000	0.00			
17	30	do	do	80	150,000	50.0	1,875	85,000	1,063	1,000,000	.04			
18	30	do	do	80	150,000	50.0	1,875	85,000	1,063	1,000,000	.00			
		Average		80	150,000	50.0	1,875	85,000	1,063	1,000,000		48.0	32.9	72.9

SERIES III.—LONG ECCENTRIC JOINTS BROKEN.

19	27	12 by 12 by 12	Horizontal	240	470,000	78.3	1,958	260,000	1,083	2,000,000	0.02			
20	31	do	do	240	470,000	78.3	1,958	260,000	1,083	2,000,000	.04			
21	30	do	do	240	470,000	78.3	1,958	260,000	1,083	2,000,000	.00			
22	24	8 by 12 by 12	Horizontal	80	150,000	50.0	1,875	85,000	1,063	1,000,000	.02			
23	31	do	Horizontal	127	250,000	83.3	1,969	150,000	1,181	2,000,000	.06			
24	29	do	Horizontal	80.8	150,000	50.0	1,855	85,000	1,052	1,000,000	.02			

SERIES IV.—LONG CONCENTRIC JOINTS BROKEN.

25	28	12 by 12 by 12	Vertical	240	470,000	78.3	1,958	260,000	1,083	2,000,000	0.05			
26	28	do	do	240	470,000	78.3	1,958	260,000	1,083	2,000,000	.00			
		Average		240	470,000	78.3	1,958	260,000	1,083	2,000,000		48.0	32.9	72.9
27	28	8 by 12 by 12	Vertical	80	150,000	50.0	1,875	85,000	1,063	1,000,000	0.05			
28	28	do	Vertical	80	150,000	50.0	1,875	85,000	1,063	1,000,000	.00			
		Average		80	150,000	50.0	1,875	85,000	1,063	1,000,000		48.0	32.9	72.9

SERIES V.—LONG CONCENTRIC JOINTS BROKEN.

29	26	8 by 12 by 12	Horizontal	80	150,000	50.0	1,875	85,000	1,063	1,000,000	0.05			
30	28	do	Horizontal	80	150,000	50.0	1,875	85,000	1,063	1,000,000	.00			
		Average		80	150,000	50.0	1,875	85,000	1,063	1,000,000		48.0	32.9	72.9

SERIES VI.—LONG CONCENTRIC JOINTS NOT BROKEN.

31	30	12 by 12 by 12	Horizontal	240	491,000	44.7	822	1,450	305	1,852,000	0.01	38.8	34.3	47.3
32	30	do	Horizontal	80	161,000	21.8	300	1,370	850	1,586,000	.01	64.0	71.0	66.3

Natco Header Tile
Natco Unglazed Double Shell Combed Face Tile
Natco Double Shell Load Bearing Backer Tile
Natco Double Shell Load Bearing Tile

REPORT OF TEST MADE AT WATERTOWN ARSENAL

No. 3689 — 8″ x 5″ x 12″ Header Tile.
8″ x 5″ x 12″ Unglazed Double Shell Combed Face Tile.
8″ x 12″ x 10½″ Double Shell Load Bearing Backer Tile.
8″ x 12″ x 12″ Double Shell Load Bearing Tile.

Compressed surfaces faced with plaster of paris to secure an even bearing in the testing machine.

Block	Net Area sq. in.	Gross area	Load lbs.	Lbs. per sq. in. net	Lbs. per sq. in.	Remarks
A (8 x 5 x 12 Header)	42	96	130,000	3095	1355	Plain
B (8 x 12 x 5 Un. Gl. D. S.)	52	96	233,000	4481	2427	Plain
C (8 x 12 x 10½ D. S. L. B.)	50	96	259,800	5196	2706	Plain
D (8 x 12 x 12 D. S. L. B.)	50	96	245,000	4900	2552	Plain

Absorption Test—Immersed in water for 48 hours

Block	Before Immersion	After Immersion	Percentage of absorption
A	14½ lbs.	15 lbs.	3.45%
B	18 lbs.	19 lbs.	6.25%
C	34 lbs.	35½ lbs.	4.28%
D	38½ lbs.	39 lbs.	1.3%

Respectfully,
T. C. DICKSON, Col. Ord. Dept. U. S. A., Commanding.
Test made Dec. 14, 1925 By (Signed) F. C. LANGENBERG, Metallurgist.

Natco Bakup Tile

LABORATORY NO. 53573
NOVEMBER 20, 1924

REPORT OF TEST OF VITRIFIED BUILDING TILE (NATCO BAKUP) COMPRESSION TEST

Mark	Dimensions inches	Gross area sq. in.	Net sectional area sq. in.	Crushing load lbs.	Crushing strength per gross area	Lbs. per sq. in. per net area
No. 1	11.87 x 8.00 x 5.00	94.9	17.8	113,560	1196	6381
No. 2	12.00 x 8.00 x 5.00	96.0	18.0	112,480	1171	6248
No. 3	11.75 x 8.00 x 5.00	94.0	23.5	127,060	1351	5407
No. 4	11.81 x 7.87 x 5.00	92.9	24.3	106,230	1143	4372

Sample No. 1.....Average Thickness of Web—$\frac{7}{16}$″ Shells—$\frac{3}{8}$″ Plain Side—$\frac{1}{2}$″ Grooved Side
Sample No. 2.....Average Thickness of Web—$\frac{7}{16}$″ Shells—$\frac{3}{8}$″ Plain Side—$\frac{1}{2}$″ Grooved Side
Sample No. 3.....Average Thickness of Web—$\frac{5}{8}$″ Shells—$\frac{1}{4}$″ Plain Side—$\frac{3}{8}$″ Grooved Side
Sample No. 4.....Average Thickness of Web—$\frac{5}{8}$″ Shells—$\frac{3}{4}$″ Plain Side—$\frac{1}{4}$″ Grooved Side

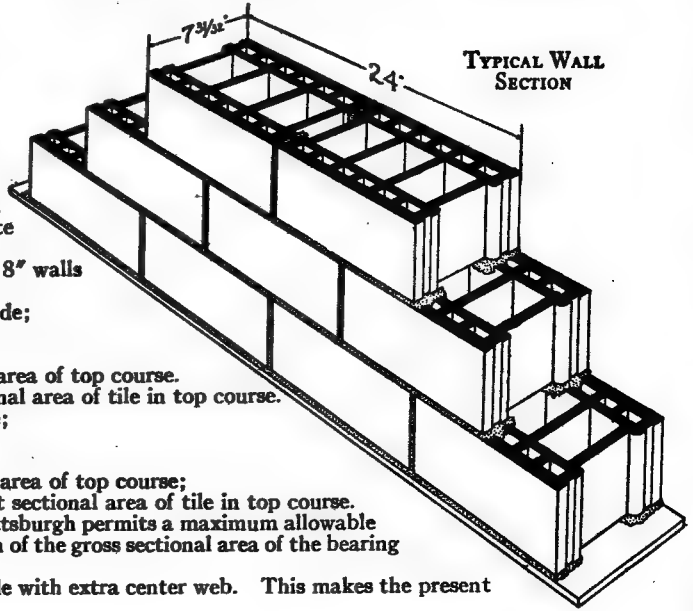
Sample No. 1 from EAST PALESTINE, OHIO
Sample No. 2 from EAST PALESTINE, OHIO
Sample No. 3 from WAYNESBURG, OHIO
Sample No. 4 from WAYNESBURG, OHIO

PITTSBURGH TESTING LABORATORY,
(Signed) J. W. REIFSNYDER, Engineer of Tests.
8x5x12 Bakup

RESULT OF COMPRESSION TESTS ON WALL SECTIONS
TEX-TILE AND GLAZED DOUBLE SHELL TILE

Conducted by Carnegie Institute of Technology, Pittsburgh, Pa., Aug. 27, 1918

Tests made for BUILDING CODE COMMISSION, City of Pittsburgh



TYPICAL WALL SECTION

Four walls were built and tested at age of 28 days.

Tile laid on end, as shown, by an experienced bricklayer.

Mortar joints ⅜ of an inch, 1 part cement, 1–10 part hydrated lime, 2 parts sharp sand—by loose volume.

Mortar specimens 28 days old tested 358 lbs. per sq. in. in tension and 2,900 lbs. per sq. in. compression; being respectively standard briquettes and cylinders 2 in. in diameter and 4 in. high.

Each wall built on ½″ steel plate; first course bedded in mortar, and plaster of paris cap placed on top just before loading.

Tested in 500,000-lb. Olsen Machine; all loads applied at rate of 0.25″ per minute.

The following are average results for two 6″ walls and two 8″ walls tested:

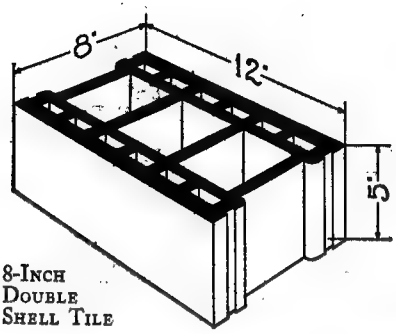
Dimensions of top course—6″ wall; 24½″ long by 5 11/16″ wide;
Area of top course—145 square inches;
Total maximum load—202,520 pounds;
Unit maximum load—1,400 pounds per square inch gross area of top course.
2,548 pounds per square inch sectional area of tile in top course.

Dimensions of top course—8″ wall; 24″ long by 7 11/16″ wide;
Area of top course—189 square inches;
Total maximum load—206,600 pounds;
Unit Maximum load—1,090 pounds per square inch gross area of top course;
2,334 pounds per square inch of net sectional area of tile in top course.

Based on these tests the present Ordinance of the City of Pittsburgh permits a maximum allowable unit working stress of 150 pounds per square inch in compression of the gross sectional area of the bearing walls in which the tile is set with cells vertical in the wall.

Please note that all of the 8″ x 12″ x 5″ units are now made with extra center web. This makes the present tile stronger than that used in the above test.

Natco Double Shell Tile



8-Inch
Double
Shell Tile

RESULTS OF TESTS PROVE THAT THIS NATCO DOUBLE SHELL TILE WILL WITHSTAND MANY TIMES THE LOAD THAT IS REQUIRED IN THE AVERAGE BUILDING

COMPRESSION TESTS OF SINGLE UNITS OF DOUBLE SHELL TILE

Conducted by Carnegie Institute of Technology, Pittsburgh, Pa., July, 1918

Number of Specimen	Nominal Size	Net Area (Sq. In.)	Gross Area per Square Inch	Maximum Load		
				Total (Lbs.)	Units (Lbs. per Sq. In.)	
					Net Area	Gross Area
1	8" x 12" x 5"	44.25	96	299450	6770	3120
2	8" x 12" x 5"	44.25	96	256580	5840	2700
3	8" x 12" x 5"	44.25	96	285280	6450	2970
4	6" x 12" x 5"	39.75	72	238000	5990	3310
5	6" x 12" x 5"	39.75	72	311650	7840	4320
6	6" x 12" x 5"	39.75	72	270510	6810	3760
7	8" x 12" x 5"	44.25	96	224760	5080	2340
8	6" x 12" x 5"	39.75	72	252050	6340	3500

NOTE—Specimens No. 7 and No. 8 were glazed Specimen No. 7 showed a detail failure at one end due likely to improper bedding which no doubt explains the low result obtained.

All tile were tested on end and were bedded in plaster of paris on top and bottom, the plaster of paris cap extending over the webs so that the full cross-section of the tile was in bearing. The sizes tested were 8"x 12" x 5" and 6" x 12" x 5".

Natco Unglazed Textile

PITTSBURGH TESTING LABORATORY
PITTSBURGH, PA.
LABORATORY NO. 61235
DECEMBER 24, 1927

REPORT OF TEST OF 8″x12″x5″ UNGLAZED TEX-TILE FROM EAST CANTON, OHIO FOR NATIONAL FIRE PROOFING COMPANY FULTON BUILDING, PITTSBURGH, PA. ABSORPTION TEST

Mark	Original Weight Grams	Final Weight Grams	Gain Grams	Absorption Per Cent
No. 1.....	371	385	14	3.8
No. 2.....	257	268	11	4.3

PITTSBURGH TESTING LABORATORY,
J. W. REIFSNYDER,
Engineer of Tests.

Natco Unglazed Textile

PITTSBURGH TESTING LABORATORY
PITTSBURGH, PA.
LABORATORY NO. 61238
DECEMBER 22, 1927

REPORT OF TESTS 8″x12″x5″ UNGLAZED TEX-TILE FROM EAST CANTON, OHIO FOR NATIONAL FIRE PROOFING COMPANY FULTON BUILDING, PITTSBURGH, PA. COMPRESSIVE TEST (Cells Vertical)

Mark	Weight in Pounds	Dimensions Inches	Gross Area sq. in.	Crushing Load lbs.	Crushing strength lbs. per sq. in. in gross area
No. 1.....	19.50	7.75″x11.88″x4.88″	92.07	630000	6844
No. 2.....	19.81	7.75″x11.88″x4.88″	92.07	599600	6513

PITTSBURGH TESTING LABORATORY,
J. W. REIFSNYDER,
Engineer of Tests.

Natco Double Shell Load Bearing Tile

THE DETROIT TESTING LABORATORY
DETROIT, MICHIGAN

Corrected Report.

Sample from The Stoddard-Dick Company — Number 0217-C-2
Sample of Natco Double Shell Load Bearing Tile — Date 2-17-25
Remarks Compression Tests — D. T. L. Order 27168

8x12x12 D.S.L.B.

Tile	Dimensions in inches	Gross area sq. in.	Weight lb. oz.	Crushing actual	Strength lbs. per sq. in.
No. 1.....	7.90 x 12.00 x 13.10	103.49	48—0	201,000	1,950 lbs.—Side
No. 2.....	8.00 x 11.96 x 13.20	105.60	48—6	172,300	1,636 lbs.—Side
No. 3.....	8.00 x 12.00 x 12.90	96.00	47—9	250,830	2,610 lbs.—End
No. 4.....	8.00 x 12.00 x 13.00	96.00	46—0	266,410	2,775 lbs.—End
No. 5.....	8.00 x 12.00 x 12.99	96.00	48—8	215,050	2,240 lbs.—End

Number 0206-6-3
Sample of Stoddard-Dick Company — Date 2-6-25
Sample of 5 Natco Tile — Customer's Order.....
Remarks Compression Tests — D. T. L. Order 27053

12x12x12 D.S.L.B.

Tile	Dimensions in inches	Gross Area sq. in.	Weight lbs.	Crushing strength		Tested
				Actual	Lbs. per sq. in.	
No. 1.....	11.8 x 11.8 x 13.3	139.24	58	302,000	2,170 lbs.x	On End
No. 2.....	11.9 x 11.8 x 13.25	141.61	58.25	300,000	2,110 lbs.xx	On End
No. 3.....	11.8 x 11.8 x 13.2	139.24	57.25	240,950	1,730 lbs.	On End
No. 4.....	11.9 x 11.9 x 13.25	141.61	59.50	305,500	2,130 lbs.xx	On End
No. 5.....	11.8 x 11.9 x 13.2	155.78	57.73	117,430	760 lbs.	On Side

xStarted to fail at capacity of machine.
xxDid not fail at capacity of machine.
——————— Test, January 16, 1928.
Corrected.

Natco Double Shell Load Bearing Tile

ADDISON F. HOLMES
ASSOCIATE PROFESSOR OF APPLIED MECHANICS
MASSACHUSETTS INSTITUTE OF TECHNOLOGY
CAMBRIDGE, MASS.

Cambridge, Mass., Mar. 29, 1927.

Report of Compression Tests on
8x8x16 DOUBLE SHELL
For
National Fire Proofing Co.

	Specimen No.	Dimension (ins.)	Breaking Load (lbs.)	Compressive strength (Lbs. per sq. in. gr. area)
TILE TESTED ON SIDE	1	8 x 8 x 16	124100	970
	2	8 x 8 x 16	159900	1250
	3	8 x 8 x 16	100800	790
	4	8 x 8 x 16	130200	1020
	5	8 x 8 x 16	117900	920
				Average 990
TILE TESTED ON END	6	8 x 8 x 16	270300	4230
	7	8 x 8 x 16	225900	3530
	8	8 x 8 x 16	132000	2060
	9	8 x 8 x 16	227700	3550
	10	8 x 8 x 16	146900	2300
				Average 3130

Tile faced with Plaster of Paris before testing.
Tested by the writer in the laboratories of the Massachusetts Institute of Technology.

Respectfully submitted,
(Signed) ADDISON F. HOLMES

Natco Building Blocks

PITTSBURGH TESTING LABORATORY
PITTSBURGH, PA.

Laboratory No. 54877 July 25, 1925.

Report of Test of Tile
For
National Fire Proofing Company, Fulton Building,
Pittsburgh, Pa.

10x8x16 BUILDING BLOCK

COMPRESSION TEST

Dimensions Inches	Gross area sq. in.	Net area sq. in.	Crushing load lbs.	Crushing strength Lbs. per sq. in.	
				Gross area	Net area
15.75 x 10.00 x 7.70...	157.5	38.74	157,200	998	4053

PITTSBURGH TESTING LABORATORY,
J. W. REIFSNYDER,
Engineer of Tests.

Natco Unibacker Tile

PITTSBURGH TESTING LABORATORY
PITTSBURGH, PA.
LABORATORY NO. 62084
CUSTOMER'S NO.—LETTER 5/23/28
JUNE 5, 1928

REPORT OF TEST OF UNIBACKER TILE FROM HAYDENVILLE, OHIO FACTORY FOR NATIONAL FIRE PROOFING COMPANY FULTON BUILDING, PITTSBURGH, PA.

COMPRESSION TEST

Mark	Dimensions Inches	Loaded Area sq. in.	Crushing Load pounds	Crushing strength lbs. per sq. in. gross area
No. 1	7.56"x7.88"x12.00"	94.56	99840	1045
No. 2	7.63"x7.88"x12.06"	95.03	112330	1182
No. 3	7.63"x7.94"x12.06"	95.78	94610	988

Remarks—Wgt. in Lbs.
No. 1 24.13
No. 2 23.56
No. 3 23.56

Remarks—Sand-cement mortar was used to fill up header brick recess.

PITTSBURGH TESTING LABORATORY
J. W. REIFSNYDER,
Engineer of Tests.

Natco Unibacker Tile

PITTSBURGH TESTING LABORATORY
PITTSBURGH, PA.
LABORATORY NO. 61426
FEBRUARY 2, 1928

REPORT OF TEST OF UNIBACKER TILE (EAST PALESTINE PLANT) FOR NATIONAL FIRE PROOFING COMPANY FULTON BUILDING, PITTSBURGH, PA.

COMPRESSION TEST

Mark	Weight Pounds	Dimensions Inches	Sectional area sq. in.	Crushing load lbs.	Crushing strength lbs. per sq. in.
No. 1-1	23.12	7.62"x7.87"x12.00"	93.4	105420	1128
No. 1-2	23.31	7.62"x7.87"x12.12"	95.2	80930	850
No. 1-3	23.25	7.75"x7.87"x12.00"	93.4	80680	863
No. 2-1	23.00	7.75"x7.94"x12.06"	95.7	95700	1000
No. 2-2	23.18	7.75"x7.87"x12.00"	93.4	104300	1116
No. 2-3	23.31	7.75"x7.94"x12.00"	95.2	90500	950
No. 3-1	23.42	7.68"x7.83"x12.12"	94.8	101000	1065
No. 3-2	23.50	7.68"x7.83"x12.00"	93.9	77800	828
No. 3-3	23.37	7.68"x7.87"x12.00"	93.4	84650	906
No. 4-1	23.50	7.75"x7.87"x11.94"	93.9	129200	1376
No. 4-2	23.92	7.75"x8.00"x12.00"	96.0	125800	1310
No. 4-3	23.82	7.75"x8.00"x12.00"	96.0	84700	882

PITTSBURGH TESTING LABORATORY,
J. W. REIFSNYDER,
Engineer of Tests.

COLUMBIA UNIVERSITY
DEPARTMENT OF CIVIL ENGINEERING
TESTING LABORATORY
NEW YORK CITY

Date 11-30-27

Machine used—400,000 Olsen | V-400 Vitritile From East Canton, Ohio | Made for National Fire Proofing Co. Broadway & 23rd Street, New York City

REPORT OF COMPRESSION

Tested J. H. KENYON and C. OPSAHL.

Material..... VITRITILE—3¾"x5"x12" (V-400) from East Canton, O.
Source..... National Fire Proofing Co.

Laboratory Test Number	39738	—39	—40
Description	Semi-Glazed	Unglazed Medium	Glazed
Mark on Test-Piece	No. 1	No. 2	No. 3
Shape of Test-Piece	5 Cells	5 Cells	5 Cells
How Tested	Cells Horizontal	Cells Horizontal	Cells Horizontal
Bedded with	Cement Mortar	Cement Mortar	Cement Mortar
Length, In Inches	12.00	11.98	12.00
Width, In Inches	3.74	3.75	3.78
Height, In Inches—Mortar	5.25	5.25	5.25
Gross Area, In square Inches	44.9	44.9	45.4
Net Area, In square Inches	24.0	24.0	24.0
Maximum Load, In pounds	112000	107900	150300
Ultimate Strength, lbs. per sq. in.—Gross	2495	2405	3310
Ultimate Strength, lbs. per sq. in.—Net	4670	4490	6260

TESTING LABORATORY,
(Signed) W. J. KREFELD,
Columbia University.

Natco Vitritile

PITTSBURGH TESTING LABORATORY
PITTSBURGH, PA.
LABORATORY NO. 61236
DECEMBER 23, 1927

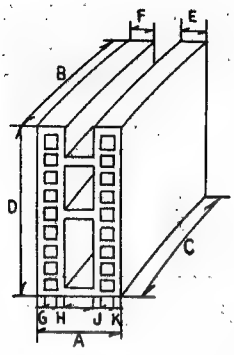
REPORT OF TEST OF
4"x5"x12" VITRITILE FROM EAST CANTON, OHIO (V 890)

For
National Fire Proofing Company
Fulton Building, Pittsburgh, Pa.

Mark	Weight in Pounds	Dimensions Inches	Gross area sq. in.	Crushing Load lbs.	Crushing Strength lbs. per sq. in. in gross area
No. 1	9.19	4.88"x3.75"x12.00"	45.00	66,400	1475
No. 2	9.31	4.88"x3.75"x12.00"	45.00	95,150	2114
No. 3	9.38	4.88"x3.75"x12.00"	45.00	106,700	2374

PITTSBURGH TESTING LABORATORY,
J. W. REIFSNYDER,
Engineer of Tests.

We shall be very glad to furnish additional data on Natco Vitritile if requested.



COLUMBIA UNIVERSITY
TESTING LABORATORIES
BROADWAY AND 117TH ST.
NEW YORK CITY
JANUARY 2, 1920

RECORD OF COMPRESSION TESTS
NATCO SILO TILE

Test Pieces from Factory at Haydenville, Ohio
All Bearing Surfaces Bedded With Neat Cement

Tests with Bearing on Full Block.

Laboratory Test Number	9019	9020	9021	9022	9023
Mark on Test-Piece	1	2	3	4	5
Dimensions of A	6.10	6.10	6.15	6.05	6.02
Test-Piece in B	12.55	12.70	12.42	12.30	12.42
Inches C	11.50	11.40	11.45	11.35	11.40
Av. B & C	12.03	12.05	11.94	11.83	11.91
D	12.45	12.40	12.44	12.40	12.40
E	2.00	1.85	1.90	1.90	2.10
F	1.90	1.85	1.85	1.90	2.26
G	0.60	0.60	0.57	0.60	0.56
H	0.50	0.50	0.48	0.50	0.55
J	0.50	0.54	0.57	0.50	0.52
K	0.60	0.52	0.60	0.50	0.51
Gross Area in sq. in.	73.40	73.50	73.48	71.60	71.70
Net Area in sq. in.	26.48	28.02	26.52	24.85	25.48
First Crack, pounds	80,000	90,000	52,000	42,000	36,000
Maximum Load, pounds	117,430	106,650	89,370	102,080	58,860
Net Strength, lb. per sq. in.	4,440	4,100	3,370	4,110	2,310
Gross Strength, lb. per sq. in.	1,600	1,450	1,215	1,427	822

Tests with Bearing on Inner Wall of Block.

Compression in Inches at Loads recorded for corresponding Test-Pieces

Laboratory Test Number	9024	9025	9026	9027	9025	9026
Mark on Test-Piece	6	7	8	9	7	8
Dimensions of A	6.05	6.10	6.08	6.10	.....	.....
Test-Piece in B	12.36	12.30	12.37	12.24	.....	.....
Inches C	11.43	11.37	11.35	11.13	.....	.....
D	12.30	12.40	12.40	12.40	.....	.....
E	1.87	2.00	1.86	1.80	.....	.....
G	0.60	0.57	0.58	0.63	.....	.....
H	0.55	0.48	0.50	0.45	.....	.....
J	0.52	0.50	0.48	0.50	.....	.....
K	0.51	0.57	0.58	0.55	.....	.....
Gross Area in sq. in.	21.38	22.74	21.00	20.05	.....	.....
Net Area in sq. in.	11.78	12.16	12.03	11.70	.....	.....
Intermediate Load, pounds	.....	3,800	3,800	.....	0.006	0.012
First Crack, pounds	22,800	22,780	29,350	32,500	0.036	0.057
Load near Failure, pounds	.....	36,350	36,850	.....	0.049	0.067
Maximum Load, pounds	39,360	47,900	44,800	63,290	.....	.....
Gross Strength, lb. per sq. in.	1,842	2,105	2,130	3,155	.....	.....
Net Strength, lb. per sq. in.	3,345	3,940	3,725	5,405	.....	.....

Natcoflor

Columbus, Ohio, May 22, 1923.

The following report is made of compression tests on sample of 6″, 8″, 10″ and 12″ Natcoflor Tile as received from your factories in Ohio.

The capping used was three parts (by weight) Portland cement and one part gypsum, allowed to age thirty-five days. The load was applied endwise and the pieces were tested to destruction.

COMPRESSION TESTS OF NATCOFLOR TILE

No.	Bearing Area			Compression Load				Color
	Dimensions Inches	Area Sq. Ins.		Actual Thousands of Lbs.	Maximum	Maximum Pounds per Sq. In.		Buff
		Gross	Net	First Crack		Gross	Net	
1	8½	62.5	32.6	132	255.0	4080	7820	Medium
2	by	62.5	33.8	182	264.7	4230	7830	Medium
3	10¼	62.5	31.4	160	223.0	3570	7100	Medium
					Average	3960	7583	
4	7¾	78.8	38.5	210	288.6	3680	7910	Light
5	by	78.8	37.8	200	324.8	4120	8590	Medium
6	10½	78.8	36.7	192	265.0	3360	7420	Light
					Average	3713	7973	
7	9¾	100	40.3	160	293.8	2838	7290	Medium
8	by	100	40.0	120	292.3	2923	7310	Medium
9	10¼	100	41.0	118	305.6	3056	7450	Medium
					Average	2972	7350	
10	11½	118	49.5	170	264.4	2240	5340	Medium
11	by	118	49.1	185	252.0	2140	5130	Medium
12	10½	118	48.5	152	250.0	2120	5160	Dark
					Average	2167	5210	

Date of Test—May 21, 1923.

(Signed) HORACE JUDD, M.E.,
Professor of Hydraulic Engineering.
The Ohio State University.

Natcoflor

PITTSBURGH TESTING LABORATORY
PITTSBURGH, PA.

Pittsburgh, Pa., Aug. 4, 1916.

Report of Test of "NATCOFLOR" Tile.
Laboratory No. 43890.

CRUSHING TEST

Marks	Sectional area square inch	Crushing load in pounds	Crushing strength per square inch in lbs.
No. 1	34.8	249,400	7167
No. 2	34.8	264,500	7601
No. 3	34.8	316,000	9080
No. 4	34.8	332,660	9560
No. 5	30.7	357,460	11640
No. 6	30.7	313,300	10200

Special rib in corner.

PITTSBURGH TESTING LABORATORY,
(Signed) JOHN H. BAILEY, Secretary.

DEPARTMENT OF COMMERCE & LABOR
BUREAU OF STANDARDS

TEST RECORD **PITTSBURGH LABORATORY**

Subject of Test—One NATCOFLOR Slab. Lab. File No. P 354
Submitted by—National Fire Proofing Co. Test No. 14
Building of slab superintended by the Bureau of Standards. Date built— 10–15–15 16
Date tested—11–17–15 18
Test required—Transverse to destruction.
Observer—J. G. Bragg. Computer—Bragg. Checked by J. G. B.
Date finished—11–20–15
Machine used—Pig lead distributed over slab. Time.....Fee.....
Approved.....

DESCRIPTIVE MATTER

The test slab consisted of two spans 15 ft. center to center. The supporting concrete piers, made of 1:3:5 gravel concrete, were finished Oct. 8, 1915. The slab was built on top the supports Oct. 14 and 15, 1915. The slab was 5'10" wide, and was made up of 4 full and 2 half tiles (one on each side), making 5 ribs 2" wide which were grouted with 1:2 cement mortar and reinforced with one ¾" square bar and one ½" square bar in each rib, as per drawing 1286C submitted by the National Fire Proofing Company. The tile used were 8" deep and placed 14" on centers. Pieces of tile were placed over the end of the tile where the slabs met the piers to prevent the concrete from running inside the tiles.

The slab was loaded by placing pigs of lead on top the slab, each pig weighing 93 pounds, there being 63 piles from one end of slab system to the other and 3 piles wide, making a total of 189 pigs for each layer.

The weight of the pigs were determined both from the car weights (100,089 pounds—1074 pigs), and by weighing 20 pigs on a 300 pound Fairbanks scale and taking the average.

The deflection measurements were taken with an engineer's level by placing a rod reading to .001 ft. on steel bars placed upright in the mortar ribs.

TEST DATA

Nov. 16th—The slabs were loaded to 315 lbs. per sq. ft. The maximum deflection at this load was:

East span .002 ft.
West span No deflection

The load was removed and both slabs came back to their original position. All of the east slab and a part of the west slab were again loaded to 315 lbs. per sq. ft., this load remaining on slab over night, when the loading was completed on the west slab.

Nov. 17th—The maximum deflection checked with that of the same load on Nov. 16th.

The slab was then loaded to 525 lbs. per sq. ft., the deflection for this load being recorded as follows:

East span .049 ft., or 38/64"
West span .033 ft., or 25/64"

Minute hair cracks were starting to form in the mortar joints on bottom of slab at this load. The load was removed and set recorded as follows:

East span .019 ft.
West span .010 ft.

The slab was then loaded to 315 lbs. per sq. ft. This load was left on over night.

Nov. 18th—The load was increased to failure.
East slab failed at 603 pounds per sq. ft.
East support broke off near ground simultaneously with failure of slab.
West slab failed at 695 lbs. per sq. ft.
Deflection in East slab, .169. Deflection in west slab, .042.
These deflection readings were taken just before failure of East slab.

Notes on Failure:

When East slab failed the steel at the center foundation was exposed to view. The rods had started to scale, showing that the elastic limit of the steel had been reached.

The concrete at ends of rods in West pier was removed after failure of West slab, showing a slipping of the rods of about ¾" in the concrete.

No spalling or cracking of the tile occurred at failure.

CRUSHING TESTS ON CUBES TAKEN FROM RIB GROUT

Cube No.	Area Sq. In.	Depth Inches	Weight Kg.	Load Lbs.	Load Lbs. per Sq. In.
1	36	5.8	7.029	80700	2240
2	36	5.8	6.890	76300	2120
3	36	5.8	7.085	84300	2340

CRUSHING TESTS ON SAMPLES OF TILE USED

Tile No.	Area Sq. In.	Over All Dimensions			Crushing Load	
		Depth Inches	Breadth Inches	Thickness Inches	Load Lbs.	Load Lbs. per Sq. In.
1	43.64	12.2	12	8	473200	10830
2	43.64	12.15	12	8	498000	11400

TENSILE TESTS ON SAMPLES CUT FROM STEEL USED

No. of Specimen	Dimensions in Inches	Net Sec. Area in Sq. In.	Yield Point in Lbs.	Yield Point Lbs. per Sq. In.	Max. Load in Lbs.	Max. Load Lbs. per Sq. In.
1	.502x.506	.254	9300	36610	14170	55790
2	.750x.750	.563	18200	32330	29000	51510

No. of Specimen	Elongation in 8" (Inches)	Elongation in 8" (Per cent)	Reduced Area Sq. In.	Reduction in Area (Per cent)
1	2.40	30.0	.090	64.6
2	2.65	33.1	.192	65.9

July 3, 1928.

REPORT OF NATCOFLOR TEST AT DETROIT, MICHIGAN

Date of Test: June 14, 1928.
Building: Burtha Fisher Home for the Aged.
Location: Six Mile Road and outer Drive, Detroit, Michigan.
Architects and Engineers: Weston and Ellington, Detroit, Mich.
Contractor: Otto Misch Company, Detroit, Michigan.

The test was conducted under the supervision of the Building Department of the City of Detroit according to their standard method of conducting floor tests.

Slab and Design: A panel 18'x18' was selected at random, which constituted an 8" NATCOFLOR slab, with a span of approximately 19'6" center to center of beams. The slab was designed for a live load of 40 pounds per square foot with 2" joists of a 1:2½ grout 13" on centers, with no topping, having a rough tile surface. The beams and columns supporting the slab are of reinforced concrete, having a 1:2:4 mix. The panel was 30 days old.

Test Load: A load of 180 pounds per square foot was placed upon the slab. The load was composed of 8 layers of hollow brick laid on the 3¾"x8" face making 4½ brick per square foot per layer. Each brick weighed 5 pounds making 22½ lbs./sq. ft. per layer or 180 lbs./sq. ft. total. This load was four times the design live load plus 20 lbs./sq. ft. for cinder fill and floor.

Results: A deflection of 5/8 inches at the center of the panel was recorded after the load of 180 pounds per square foot had been on the slab 24 hours. Upon removing this load the slab came back to very near its original position, showing practically no settlement.

Remarks: The slab was tested for a maximum shearing condition by placing the edge of the load on a line where the joists joined the flanges of the concrete beams.

There are approximately 90,000 square feet of NATCOFLOR in this building consisting of about 1400 tons of NATCOFLOR tile. Electrical conduit were taken care of by using a tile of less depth where piping occurred. The grout joists were poured simultaneously with the concrete frame by changing the mix as desired. Double joists with a tile slab at the bottom were formed to take care of partitions. Where ceiling outlets were necessary, grout headers between the joists were used. 30,000 square feet of this floor was laid and poured in six days.

Those attending the test were Mr. C. A. Daymude, Chief Engineer for the Building department, City of Detroit; Mr. Lernshaw, Building Inspector; Mr. Millard, Chief Engineer for Weston and Ellington, Architects; Mr. A. Misch, Contractors; Mr. R. L. Stoddard of the Stoddard-Dick Company, Mr. W. Mohr, Engineer for Stoddard Dick Co., and Mr. E. A. Nelson, Engineer for the National Fire Proofing Company.

Submitted by: E. A. Nelson, Engineer.

July 3, 1928.

THE UNIVERSITY OF WISCONSIN
COLLEGE OF ENGINEERING
DEPARTMENT OF MECHANICS

REPORT OF TEST OF 3¾"x12"x10½" XXX BACKER TILE MANUFACTURED AT OTTAWA, ILLINOIS PLANT

Results of Tests on Clay Building Tile.
Made for National Fire Proofing Company.
Samples selected by Manufacturer.
Scoring or facing. All faces scored 0.20-inch deep vertically.
Brands or Marks "3¾ x 10½ XXX Natco" impressed in one face of each.

WARPAGE:

No. 115 and 117—None.
No. 116—0.10—inch or 1%.

(B) COMPRESSION TEST DATA

Loaded on 3¾x12-inch ends; cells vertical. Bedded in Plaster of Paris

Mark or Number	Natco 115	Natco 116	Natco 117
Seal Number		not sealed	
Weight of Block (lb.)	15.56	15.21	15.35
Height (inches)	10.5	10.2	10.3
Dimensions of Loaded Cross Section (in.)	3.9x11.7	3.8x11.45	3.8x11.6
Area of Section (sq. in.)	45.6	43.5	44.3
Maximum load (lb.)	137,220	141,230	104,190
Ultimate Strength (lb. per sq in.)	3010	3250	2300
Color	Uniform Light Red		

Character of Fracture—Crushing at one end in No. 117; complete shear and splitting in others.

Remarks—Uniform, dense texture.

Date of Compression Test—June 19, 1926.

(C) VOIDS TEST DATA

Mark or Number	Natco 115	Natco 116	Natco 117
Section Area (sq. in.)	3.8x11.3–39.6	3.4x11.05–37.6	3.8x11.2–39.2
Number of Cells	Three rectangular cells, middle cell narrow		
Cell Dimensions (in.)	(2) 2.45x4.2–10.3	2.4x4.05–9.72	2.45x4.2–10.3
Middle Cell	2.45x1.0–2.45	2.4x1.0–2.4	2.45x1.0–2.45
Cell Area (sq. in.)	23.1	21.8	23.1
PERCENT VOIDS	58.4	58.0	58.4

(D) ABSORPTION TEST DATA

(Weight in Pounds)

Mark or Number	Natco 115	Natco 116	Boiling Test Natco 117
Weight after Immersion in water 1 hour	16.90	15.95	16.54
Weight, Dry Specimen	15.54	15.18	15.34
Gain in Weight	1.36	0.77	1.20
PERCENT ABSORPTION	8.75	5.08	7.82

Madison, Wisconsin, June 29, 1926.

C. A. WIEPKING,
Observer.

THE UNIVERSITY OF WISCONSIN
COLLEGE OF ENGINEERING
DEPARTMENT OF MECHANICS
LABORATORY FOR TESTING MATERIALS

REPORT OF TEST OF NATCO 6"x5"x12" HEADER TILE MANUFACTURED AT OTTAWA, ILLINOIS PLANT

Results of Tests on Clay Building Tile.
Made for National Fire Proofing Company.
Samples selected by Manufacturer.
Scoring or facing inside vertical face plain; all other faces scored 0.20 in.
Brands or Marks "NATCO 6x5 PATENT APLD FOR" impressed in each.

WARPAGE:

0.10 inch or 0.833% in No. 91.
0.05 inch or 0.417% in others.

(B) COMPRESSION TEST DATA

Loaded on 6x12-inch faces; cells horizontal. Bedded in No. 5 Stucco

Mark or Number	Natco 91	Natco 92	Natco 93
Seal Number		not sealed	
Weight of Block (lb.)	11.90	12.09	11.59
Height (inches)	5.05	5.1	5.05
Dimensions of Loaded Cross Section (in.)	6.05x11.8	6x1x12.1	6.1x12.1
Area of Section (sq. in.)	71.4	73.8	73.8
Maximum Load (lb.)	124,850	113,320	108,460
Ultimate Strength (lb. per sq. in.)	1750	1540	1470
Color	Uniform Light Red		

Character of Fracture Uniform, dense. Very slightly laminated. Uniform red inside.
Remarks—Shear in short vertical walls in No. 92 and 93; complete shear in No. 91.
Date of Compression Test—July 1, 1926.

(C) VOIDS TEST DATA

Mark or Number	Natco 91	Natco 92	Natco 93
Section Area (sq. in.)	14.9	15.7	15.5
Number of Cells	Four cells in each (see sketch)		
Top Cell	2.2 x0.50=1.1	2.2x 0.50=1.1	2.2x 0.50=1.1
Corner Cell	8.80x0.50=0.40	0.80x0.50=0.40	0.80x0.50=0.40
2 Lower Cells	0.80x1.65=1.32	0.80x1.65=1.32	0.80x1.65=1.32
Cell Area (sq. in.)	4.14	4.14	4.14
PERCENT VOIDS	27.8	26.4	26.7

(D) ABSORPTION TEST DATA (Weight in Pounds)

Mark or Number	Natco 91	Natco 92	Boiling Test Natco 93
Weight after Immersion in water 1 hour	12.78	13.54	12.92
Weight, Dry Specimen	11.84	12.06	11.54
Gain in Weight	0.94	1.48	1.38
PERCENT ABSORPTION	7.94	12.28	11.95

Madison, Wisconsin, July 3, 1926.

C. A. WIEPKING,
Observer.

THE UNIVERSITY OF WISCONSIN
COLLEGE OF ENGINEERING
DEPARTMENT OF MECHANICS

REPORT OF TEST OF NATCO 6"x12"x10¾" DOUBLE SHELL BACKER TILE MANUFACTURED AT OTTAWA, ILLINOIS PLANT

Results of Tests on Clay Building Tile.
Made for National Fire Proofing Co.
Sampled selected by Manufacturer.
Scoring or facing—Side faces scored 0.15"; ends 0.20-inch.
Brands or Marks—"NATCO HEADER-BACKER PATENTED" impressed in each.

WARPAGE:

None in No. 67.
0.20-inch in No. 68 or 0.17%.
0.02-inch in No. 69 or 0.417%.

(B) COMPRESSION TEST DATA

Loaded on 6x12-inch ends; cells vertical. Bedded in Plaster of Paris

Mark or Number	Natco 67	Natco 68	Natco 69
Seal Number		not sealed	
Weight of Block (lb.)	27.8	27.6	27.8
Height (inches)	10.65	10.7	10.68
Dimensions of Loaded Cross Section (in.)	6.2x12.0	6.2x12.1	6.2x12.0
Area of Section (sq. in.)	74.4	75.0	74.4
Maximum Load (lb.)	182,000	185,000	163,000
Ultimate Strength (lb. per sq. in.)	2180	2460	2190
Color	Uniform Light Red to Orange.		

Character of Fracture—Uniform, dense texture; no laminations, light red color.
Remarks—Crushing at one end in No. 67; complete shear and crushing in others.
Date of Compression Test—June 18, 1928.

(C) VOIDS TEST DATA

Mark or Number	Natco 67	Natco 68	Natco 69
Section Area (sq. in.)	5.9x11.6=68.4	5.9x11.7=69.0	5.9x11.6=68.4
Number of Cells	Three large and 12 small cells in each		
Cell Dimensions (inch):			
Middle Cell	2.4 x3.2=7.68	2.4 x3.2=7.68	2.4 x3.2=7.68
2 Outer Cells	2.4 x2.7=6.48	2.4 x2.7=6.48	2.4 x2.7=6.48
12 Small Cells	0.75x1.4=1.05	0.75x1.4=1.05	0.75x1.4=1.05
Cell Area (sq. in.)	34.9	34.9	34.9
PERCENT VOIDS	51.0	50.6	51.0

(D) ABSORPTION TEST DATA (Weight in Pounds)

Mark or Number	Natco 67	Natco 68	Natco 69
Weight after Immersion in Water 1 Hour	31.86	31.00	30.86
Weight, Dry Specimen	27.76	27.60	27.80
Gain in Weight	4.10	3.40	3.15
PERCENT ABSORPTION	14.80	12.32	11.32

Madison, Wisconsin, July 2, 1928.

C. A. WIEPKING,
Observer.

THE UNIVERSITY OF WISCONSIN
COLLEGE OF ENGINEERING
DEPARTMENT OF MECHANICS
LABORATORY FOR TESTING MATERIALS

REPORT OF TEST OF NATCO 8"x5"x12" HEADER TILE MANUFACTURED AT OTTAWA, ILLINOIS PLANT

Result of Tests on Clay Building Tile.
Made for National Fire Proofing Co.
Sample selected by Manufacturer.
Brands or Marks—"Natco Header-Backer Patent Apld For" impressed in each.

WARPAGE:

0.05-inch or 0.417% in No. 94.
No warpage in others.

(B) COMPRESSION TEST DATA

Loaded on 8x12-inch faces; cells horizontal. Bedded in No. 5 Stucco

Mark or Number	Natco 94	Natco 95	Natco 96
Seal Number		not sealed	
Weight of Block (lb.)	16.17	16.02	15.85
Height (Inches)	5.05	4.9	4.9
Dimensions of Loaded Cross Section (in.)	8.16x12.0	8.0x11.7	7.96x11.7
Area of Section (sq. in.)	97.8	93.5	93.0
Maximum Load (lb.)	186,680	178,770	161,310
Ultimate Strength (lb. per sq. in.)	1902	1910	1736
Color	Uniform Light Red		

Character of Fracture—Uniform dense. Very slightly laminated.
Remarks—Shear in tall webs only in No. 94 and 96; complete shear in No. 95.
Date of Compression Test—July 1, 1926.

(C) VOIDS TEST DATA

Mark or Number	Natco 94	Natco 95	Natco 96
Section Area (sq. in.)	22.9	21.9	21.6
Number of Cells	One large and three small cells in each		
Cell Dimensions (in.)	(1) 3.6x1.45=5.07	3.4 x1.4=4.76	3.4 x1.4
3 Small Cells	0.80x1.0=0.80	0.80x1.0=1.80	0.80x1.0=1.80
Cell Area (sq. in.)	7.47	7.16	7.16
PERCENT VOIDS	32.6	32.7	33.2

(D) ABSORPTION TEST DATA (Weight in Pounds)

Mark or Number	Natco 94	Natco 95	Boiling Test Natco 96
Weight after Immersion in Water 1 hour	17.60	16.93	16.55
Weight, Dry Specimen	16.15	16.01	15.83
Gain in Weight	1.45	0.92	1.02
PERCENT ABSORPTION	8.98	5.75	6.44

Madison, Wisconsin, July 3, 1926.

C. A. WIEPKING,
Observer.

THE UNIVERSITY OF WISCONSIN
COLLEGE OF ENGINEERING
DEPARTMENT OF MECHANICS

REPORT OF TEST OF NATCO 8″x12″x10¾″ BACKER TILE MANUFACTURED AT OTTAWA, ILLINOIS PLANT

Results of Tests on Clay Building Tile.
Made for National Fire Proofing Company.
Samples selected by Manufacturer.
Scoring or facing—Side faces scored 0.15-inch; ends 0.20-inch.
Brands or Marks—"NATCO HEADER-BACKER PATENT APLD FOR" impressed in each.

WARPAGE:

0.10-inch or 1% in No. 73.
0.05-inch or 0.5% in others.

(B) COMPRESSION TEST DATA

Loaded on 8x12-inch ends. Cells vertical			Bedded in Plaster of Paris
Mark or Number	Natco 73	Natco 74	Natco 75
Seal Number		not sealed	
Weight of Block (lb.)	36.8	37.1	36.8
Height (inches)	10.7	10.65	10.7
Dimensions of Loaded Cross Section (in.)	8.15x12.0	8.2x12.0	8.15x12.0
Area of Section (sq. in.)	97.8	98.4	97.8
Maximum Load (lb.)	238,000	365,000	365,000
Ultimate Strength	2430	3710	3730
Color	Uniform Orange Color.		

Character of Fracture—Very slightly laminated; dense texture. Uniform.
Remarks—Complete failure by shear and vertical splitting in each. (Color.)
Date of Compression Test—June 18, 1926.

(C) VOIDS TEST DATA

Mark or Number	Natco 73	Natco 74	Natco 75
Section Area (sq. in.)	7.85x11.6=91.0	7.9x11.6=91.6	7.85x11.6=91.0
Number of Cells	Six large and twelve small cells in each		
Cell Dimensions (in.):			
2 Middle Cells	1.8 x3.2 =5.75	1.8 x3.2 =5.75	1.8 x3.2 =5.75
4 Outer Cells	1.8 x2.75=4.95	1.8 x2.75=4.95	1.8 x2.75=4.95
12 Small Cells	0.80x1.3 =1.04	0.80x1.3 =1.04	0.80x1.3 =1.04
Cell Area (sq. in.)	46.3	46.3	46.3
PERCENT VOIDS	50.9	50.5	50.9

(D) ABSORPTION TEST DATA (Weight in Pounds)

Mark or Number	Natco 73	Natco 74	Boiling Test Natco 75
Weight after immersion in Water 1 hour	41.30	41.85	41.40
Weight, Dry Specimen	36.80	37.10	36.80
Gain in Weight	4.50	4.75	4.60
PERCENT ABSORPTION	12.22	12.80	12.50

Madison, Wisconsin, July 2, 1926.

C. A. WIEPKING,
Observer

UNIVERSITY OF WISCONSIN
COLLEGE OF ENGINEERING
DEPARTMENT OF MECHANICS

REPORT OF TEST OF NATCO 10"x5"x12" HEADER TILE MANUFACTURED AT OTTAWA, ILLINOIS PLANT

Results of Tests on Clay Building Tile.
Made for National Fire Proofing Company.
Samples selected by Manufacturer.
Scoring or facing—Top faces scored 0.20-inch; other faces 0.15-inch inside vertical face plain.
Brands or Marks—"NATCO 10x5" impressed on top of each.

WARPAGE:

None in No. 97 and 98.
0.05-inch in No. 99, or 0.417%.

(B) COMPRESSION TEST DATA

Loaded on 10x12-inch faces; cells horizontal.

Mark or Number	Natco 97	Natco 98	Bedded in No. 5 Stucco Natco 99
Seal Number	not sealed		
Weight of Block (lb.)	18.28	17.93	18.31
Height (inches)	5.0	5.1	5.06
Dimensions of Loaded Cross Section (in.)	9.7x11.8	9.8x12.0	9.8x11.9
Area of Section (sq. in.)	114.5	117.6	116.7
Maximum Load (lb.)	222,000	134,500	177,000
Ultimate Strength (lb. per sq. in.)	1940	1144	1520
Color	Uniform Light Red		

Character of Fracture—Uniform, dense texture. Very slightly laminated.
Remarks—Complete shear in No. 97; shear in tall webs only in others.
Date of Compression Test—July 1, 1926.

(C) VOIDS TEST DATA

Mark or Number	Natco 97	Natco 98	Natco 99
Section Area (sq. in.)	30.8	31.2	31.0
Number of Cells	Two large and three small cells in each		
Cell Dimensions (in.):			
2 Cells	3.55x1.4—4.97	3.6x1.45—5.22	3.6x1.45
3 Small Cells	0.80x1.2—0.96	0.80x1.2—0.96	0.80x1.2—0.96
Cell Area (sq. in.)	12.8	13.3	13.3
PERCENT VOIDS	42.2	42.6	42.9

(D) ABSORPTION TEST DATA (Weight in Pounds)

Mark or Number	Natco 97	Natco 98	Boiling Test Natco 99
Weight after Immersion in Water 1 hour	19.28	19.63	19.69
Weight, Dry Specimen	18.21	17.89	18.26
Gain in Weight	1.07	1.74	1.43
PERCENT ABSORPTION	5.86	9.72	7.84

Madison, Wisconsin, July 3, 1926.

C. A. WIEPKING,
Observer.

THE UNIVERSITY OF WISCONSIN
COLLEGE OF ENGINEERING
DEPARTMENT OF MECHANICS
LABORATORY FOR TESTING MATERIALS

REPORT OF TEST OF NATCO 10"x12"x10½" BACKER TILE MANUFACTURED AT OTTAWA, ILLINOIS PLANT

Results of Tests on Clay Building Tile.
Made for National Fire Proofing Co.
Sampled selected by Manufacturer.
Scoring or facing—Side faces scored 0.15-inch; ends 0.20-inch.
Brands or Marks—"NATCO 10x12" on one end of each.

WARPAGE:

0.10-inch or 0.93% in No. 80.
0.05-inch or 0.46% in others.

Same shape of tile as shown in top view on Sheet 3, but having wider cells.

(B) COMPRESSION TEST DATA

Loaded on 10x12-inch ends; cells vertical. Bedded in Plaster of Paris

Mark or Number	Natco 79	Natco 80	Natco 81
Seal Number		not sealed	
Weight of Block (lb.)	38.1	38.0	38.4
Height (inches)	10.6	10.25	10.4
Dimensions of Loaded Cross Section (in.)	10.1x11.9	9.8x12.0	9.9x11.8
Area of Section (sq. in.)	120.2	116.8	116.8
Maximum Load (lb.)	215,000	280,000	239,000
Ultimate Strength (lb. per sq. in.)	1790	2380	2060
Color	Orange-Red; No. 80 lighter than others.		

Character of Fracture—Uniform, dense texture, light red color inside.
Remarks—Complete crushing and shear in No. 80; failure at one end only in others.
Date of Compression Test—June 18, 1926.

(C) VOIDS TEST DATA

Mark or Number	Natco 79	Natco 80	Natco 81
Section Area (sq. in.)	9.8x11.5=112.8	9.6x11.6=111.3	9.6x11.4=109.5
Number of Cells	Six large and twelve small cells in each		
2 Middle Cells	2.8x3.15=8.82	2.7x3.05=8.24	2.75x3.15=8.66
4 Outer Cells	2.8x2.85=7.98	2.7x2.7 =7.30	2.74x2.85=7.84
12 Small Cells	0.95x1.4=1.33	0.95x1.4=1.33	0.95x1.4=1.33
Cell Area (sq. in.)	68.9	65.0	68.0
PERCENT VOIDS	61.0	58.4	62.0

(D) ABSORPTION TEST DATA (Weight in Pounds)

Mark or Number	Natco 79	Natco 80	Boiling Test Natco 81
Weight after Immersion in Water 1 hour	41.65	39.30	39.35
Weight Dry Specimen	38.00	37.70	36.35
Gain n Weight	3.65	1.60	3.00
PERCENT ABSORPTION	9.60	4.25	8.25

Madison, Wisconsin, July 2, 1926.

C. A. WIEPKING,
Observer.

THE UNIVERSITY OF WISCONSIN
COLLEGE OF ENGINEERING
DEPARTMENT OF MECHANICS

REPORT OF TEST OF NATCO 12"x5"x12" HEADER TILE MANUFACTURED AT OTTAWA, ILLINOIS PLANT

Results of Tests on Clay Building Tile.
Made for National Fire Proofing Co.
Samples selected by Manufacturer.
Scoring or facing—All except inside vertical face scored 0.15-inch deep.
Brands or Marks—"NATCO HEADER-BACKER PATENT APLD FOR" impressed in each.

WARPAGE:

None in No. 100.
0.05-inch or 0.41% in others.

(B) COMPRESSION TEST DATA

Loaded on 12x12-inch faces; cells horizontal.

Mark or Number	Natco 100	Natco 101	Bedded in No. 5 Stucco Natco 102
Seal Number		not sealed	
Weight of Block (lb.)	24.17	24.83	24.05
Height (inches)	5.05	4.95	5.1
Dimensions of Loaded Cross Section (in.)	11.8x11.9	11.7x11.9	11.8x12.1
Area of Section (sq. in.)	140.3	139.2	144.0
Maximum Load (lb.)	280,000	229,000	198,000
Ultimate Strength (lb. per sq. in.)	1995	1645	1376
Color	Light Red	Light Red	Medium Red

Character of Fracture—Uniform, dense texture, slightly laminated. Even color.
Remarks—Complete shear in No. 100; shear in tail webs only in others.
Date of Compression Test—July 1, 1926.

(C) VOIDS TEST DATA

Mark or Number	Natco 100	Natco 101	Natco 102
Section Area (sq. in.)	41.6	40.2	42.2
Number of Cells	Three large and three small cells in each		
Cell Dimensions (in.)	(3) 3.45x1.4—4.83	3.45x1.4—4.83	3.5 x1.4—4.9
3 Small Cells	0.85x1.2—1.02	0.85x1.2—1.02	0.85x1.2—1.02
Cell Area (sq. in.)	17.5	17.5	17.8
PERCENT VOIDS	42.0	43.5	42.2

(D) ABSORPTION TEST DATA (Weight in Pounds)

Mark or Number	Natco 100	Natco 101	Boiling Test Natco 102
Weight after Immersion in Water 1 hour	26.21	26.22	26.49
Weight, Dry Specimen	24.11	24.74	24.00
Gain in Weight	2.10	1.48	2.49
PERCENT ABSORPTION	8.71	5.98	10.39

Madison, Wisconsin, July 3, 1926.

C. A. WIEPKING,
Observer.

THE UNIVERSITY OF WISCONSIN
COLLEGE OF ENGINEERING
DEPARTMENT OF MECHANICS

REPORT OF TEST OF NATCO 12"x12"x10½" BACKER TILE MANUFACTURED AT OTTAWA, ILLINOIS PLANT

Results of Tests on Clay Building Tile.
Made for National Fire Proofing Company.
Samples selected by Manufacturer.
Scoring or facing—Side faces scored 0.15-inch; ends 0.20-inch.
Brands or Marks—"NATCO HEADER-BACKER PATENT APLD FOR" impressed in each.

WARPAGE:

0.02-inch in each
or 0.19%.

(B) COMPRESSION TEST DATA

Loaded on 12x12-inch ends; cells vertical.

Mark or Number	Natco 85	Natco 86	Bedded in Plaster of Paris Natco 87
Seal Number		not sealed	
Weight of Block (lb.)	46.2	45.5	45.95
Height (inches)	10.45	10.6	10.3
Dimensions of Loaded Cross Section (in.)	11.85x11.9	11.9x12.0	11.8x11.8
Area of Section (sq. in.)	141.0	142.9	139.2
Maximum Load (lb.)	405,000	470,000	282,000
Ultimate Strength (lb. per sq. in.)	2870	3290	2020
Color	Uniform Light Red.		

Character of Fracture—Uniform. Dense Texture; very slightly laminated.
Remarks—Crushing on one side in No. 87; complete shear and splitting in others.
Date of Compression Test—June 18, 1926.

(C) VOIDS TEST DATA

Mark or Number	Natco 85	Natco 86	Natco 87
Section Area (sq. in.)	11.85x11.5—133.0	11.8x11.8—134.8	11.8x11.4—131.2
Number of Cells	Six large and twelve small cells in each		
Cell Dimensions (in.):			
2 Middle Cells	3.44x3.1—11.00	3.44x3.1—11.00	3.44x3.1—11.00
4 Outer Cells	3.44x2.6— 9.23	3.44x2.6— 9.23	3.44x2.6— 9.23
12 Small Cells	0.80x1.3— 1.04	0.80x1.3— 1.04	0.80x1.3— 1.04
Cell Area (sq. in.)	76.0	76.0	76.0
PERCENT VOIDS	57.1	56.5	57.9

(D) ABSORPTION TEST DATA (Weight in Pounds)

Mark or Number	Natco 85	Natco 86	Boiling Test Natco 87
Weight after Immersion in Water 1 hour	49.60	49.55	49.40
Weight, Dry Specimen	46.20	45.50	45.95
Gain in Weight	3.40	4.05	3.45
PERCENT ABSORPTION	7.35	8.90	7.51

Madison, Wisconsin, July 3, 1926.

C. A. WIEPKING,
Observer

THE UNIVERSITY OF WISCONSIN
COLLEGE OF ENGINEERING
DEPARTMENT OF MECHANICS
LABORATORY FOR TESTING MATERIALS

REPORT OF TEST OF 8"x7¾"x12" THREE CELL UNIBACKER TILE MANUFACTURED AT OTTAWA, ILLINOIS PLANT

Results of Tests on Clay Building Tile.
Made for National Fire Proofing Company.
Samples selected by Manufacturer
Scoring or facing—All faces scored .4 to .5-in. wide by about .15-in. deep.
Brands or Marks—NATCO UNIBACKER LOAD BEARING PATENT 1456373 (Imprinted).
Additional Information—One side of top offset, 1.3-in. deep by 4.5-in. wide; one cell in full height part and two shorter cells in offset part of main title.

WARPAGE:
Less than 0.1-in.

(B) COMPRESSION TEST DATA

Loaded on 8x12-in. faces, cells horizontal.			Bedded in No. 5 stucco
Mark or Number	4	5	6
Seal Number		not sealed	
Weight of Block (lb.)	22.4	22.2	22.7
Heights (inches)	7.4	7.4	7.4
Dimensions of Loaded Cross Section (in.)	7.7x11.8	7.7x11.8	7.7x11.9
Area of Section (sq. in.)	90.8	90.8	91.6
Maximum Load (lb.)	103,100	81,050	81,050
Ultimate Strength (lb. per sq. in.)	1140	890	890

Color—Tile and fracture; cherry red. No laminations.
Character of Fracture—In horizontal walls at junction with vertical walls.
Remarks—Date of Compression Test—September 15, 1926.

(C) VOIDS TEST DATA

Mark or Number	4	5	6
Section Area (sq. in.)	51.2	51.2	51.2
Number of Cells	three rectangular; one larger than others (high side)		
Cell Dimensions (in.)	1.9x5.8 (11.0)	1.9x5.8 (11.0)	1.9x5.8 (11.0)
Cell Dimensions (in.)	1.6x4.5 (7.2)	1.6x4.5 (7.2)	1.6x4.5 (7.2)
Cell Area (sq. in.)	25.4	25.4	25.4
PERCENT VOIDS	50	50	50

(D) ABSORPTION TEST DATA (Weight in Pounds) (On Pieces)

Mark or Number	4	5	6
Weight after Immersion in Water 1 hour	7.86	11.00	7.80
Boiling Test			
Weight, Dry Specimen	7.59	10.39	7.28
Gain in Weight	0.27	0.61	0.52
PERCENT ABSORPTION	3.6	5.9	7.1

Madison, Wisconsin, September 17, 1926.

C. A. WIEPKING,
Observer.

PITTSBURGH TESTING LABORATORY
PITTSBURGH, PA.
CHICAGO OFFICE

REPORT OF TEST
12"x7¾"x12" THREE CELL UNIBACKER TILE, MANUFACTURED AT OTTAWA, ILLINOIS, PLANT

December 7, 1928.

NATIONAL FIRE PROOFING COMPANY, 926 BUILDERS BUILDING, CHICAGO, ILLINOIS

UNIBACKER TILE LOAD BEARING—OTTAWA, ILLINOIS
12.00"x7.75x12.00"—3 CELLS

COMPRESSION TEST — CRUSHED HORIZONTAL

Mark	Weight Lbs.	Dimensions Inches Actual Size	Gross Area Sq. in.	Crushing Load Lbs.	Crushing Strength Lbs. per Sq. In. Gross Area
No. 1.....	29 lbs. 2 oz.	12.13"x12.00"	145.56"	182,500 lbs.	1254 lbs.
No. 2.....	29 lbs. 1 oz.	12.00"x12.00"	144.00"	142,500 lbs.	989 lbs.
No. 3.....	29 lbs. 2 oz.	12.13"x12.00"	145.56"	179,500 lbs.	1232 lbs.

PITTSBURGH TESTING LABORATORY,
H. H. HOLMES,
Manager Chicago District.

THE UNIVERSITY OF WISCONSIN
COLLEGE OF ENGINEERING
DEPARTMENT OF MECHANICS

REPORT OF TEST OF 4″x5″x12″ ONE CELL UNGLAZED BAKUP TILE MANUFACTURED AT OTTAWA, ILLINOIS PLANT

Results of Tests on Clay Building Tile.
Made for National Fire Proofing Company.
Samples selected by Manufacturer.
Scoring or facing—Top, bottom, and one face scored 0.20-inch deep.
Brands or Marks—"NATCO BAKUP" impressed in top of each. One face plain.

WARPAGE:

0.06-in. or 0.417% in No. 103 and 104.
None in No. 105.

(B) COMPRESSION TEST DATA

Loaded on 4x12-inch faces; cell horizontal. Bedded in Plaster of Paris

Mark or Number	Natco 103	Natco 104	Natco 105
Seal Number		not sealed	
Weight of Block (lb.)	8.00	8.06	7.92
Height (inches)	5.1	5.0	5.0
Dimensions of Loaded Cross Section (in.)	3.9x12.2	3.9x12.1	3.9x12.15
Area of Section (sq. in.)	47.6	47.2	47.4
Maximum Load (lb.)	73,370	98,350	80,620
Ultimate Strength (lb. per sq. in.)	1540	2080	1470
Color	Uniform Light Red.		

Character of Fracture—Complete shear failure in each.
Remarks—Very slightly laminated Texture. A few quartz pebbles. Even color inside.
Date of Compression Test—June 19, 1926.

(C) VOIDS TEST DATA

Mark or Number	Natco 103	Natco 104	Natco 105
Section Area (sq. in.)	4.7x3.7—17.4	4.6x3.7—17.0	4.6x3.7—17.0
Number of Cells		One rectangular cell in each	
Cell Dimensions (in.)	3.8x2.6	3.8x2.6	3.8x2.6
Cell Area (sq. in.)	9.88	9.88	9.88
PERCENT VOIDS	56.7	58.0	58.0

(D) ABSORPTION TEST DATA (Weight in Pounds)

Mark or Number	Natco 103	Natco 104	Boiling Test Natco 105
Weight after Immersion in Water 1 hour	8.82	8.78	8.69
Weight, Dry Specimen	8.00	8.04	7.91
Gain in Weight	0.82	0.74	0.78
PERCENT ABSORPTION	10.26	9.20	9.86

Madison, Wisconsin, June 29, 1926.

C. A. WIEPKING,
Observer.

UNIVERSITY OF WISCONSIN
COLLEGE OF ENGINEERING
DEPARTMENT OF MECHANICS
LABORATORY FOR TESTING MATERIALS

REPORT OF TEST OF 4″x5″x12″ ONE CELL GLAZED BAKUP TILE MANUFACTURED AT BRAZIL, INDIANA PLANT

Results of Tests on Clay Building Tile.
Made for National Fire Proofing Co.
Samples selected by Manufacturer.
Scoring or facing—Top and one face plain; other faces scored 0.05-inch deep.
Brands or Marks—None, all faces glazed.

WARPAGE:

0.05-inch in each or 0.417%

Same shape as on Sheet 13, but glazed

(B) COMPRESSION TEST DATA

Loaded on 4x12 inch faces; cell horizontal.

Mark or Number	Natco 136	Natco 137	Bedded in Plaster of Paris Natco 138
Seal Number		not sealed	
Weight of block (lb.)	9.61	9.66	9.62
Height (inches)	4.95	5.0	4.95
Dimensions of Loaded Cross Section (in.)	4.05x11.7	4.05x11.9	4.0x11.95
Area of Section (sq. in.)	47.4	48.2	47.8
Maximum Load (lb.)	142,560	116,220	156,190
Ultimate Strength (lb. per sq. in.)	3010	2410	3270
Color	Light Brown—speckled glazed surfaces, Grey-brown color inside.		

Character of Fracture—Uniform and very dense.
Remarks—Complete shear failure in No. 136; shear in one wall only in others.
Date of Compression Test—June 22, 1928.

(C) VOIDS TEST DATA

Mark or Number	Natco 136	Natco 137	Natco 138
Section Area (sq. in.)	4.9x4.0—19.6	4.95x4.0—19.8	4.9x3.95—19.4
Number of Cells		One rectangular cell in each	
Cell Dimensions (in.)	3.75x2.55	3.75x2.55	3.75x2.55
Cell Area (sq. in.)	9.56	9.56	9.56
PERCENT VOIDS	48.8	48.4	49.3

(D) ABSORPTION TEST DATA (Weight in Pounds)

Mark or Number	Natco 136	Natco 137	Boiling Test Natco 138
Weight after Immersion in Water 1 hour	9.94	10.12	9.90
Weight, Dry Specimen	9.60	9.66	9.61
Gain in Weight	0.34	0.46	0.29
PERCENT ABSORPTION	3.54	4.76	3.02

Madison, Wisconsin, July 2, 1928.

C. A. WIEPKING,
Observer.

PITTSBURGH TESTING LABORATORY
PITTSBURGH, PA.

REPORT OF TEST OF 8″x5″x12″ THREE CELL UNGLAZED BAKUP TILE MANUFACTURED AT OTTAWA, ILLINOIS PLANT

CHICAGO OFFICE
MAY 18, 1928
NATIONAL FIRE PROOFING COMPANY
CHICAGO, ILLINOIS
HOLLOW CLAY TILE, 8x5x12, THREE CELL
OTTAWA, ILL., FACTORY

COMPRESSION TEST — **CRUSHING HORIZONTAL**

Mark	Weight Lbs.	Dimensions Inches Actual Size	Gross Area Sq. In.	Crushing Load Lbs.	Crushing Strength Lbs. per Sq. In. Gross Area
No. 1	15.9	8.06x5 x12.13	97.76	82,000	839
No. 2	15.88	8 x5 x12.06	96.48	82,000	850
No. 3	15.81	8.06x5 x12.13	97.76	92,000	941
No. 4	15.88	8 x5.06x12.06	96.48	111,000	1150
No. 5	16.16	8.13x5.06x12.12	98.52	84,500	849

CRUSHED VERTICAL

No. 1	15.89	8.06x5 x12.06	40.3	78,000	1936
No. 2	16.05	8.12x5 x12.06	40.6	87,500	2155
No. 3	15.89	8.12x5 x12.06	40.6	92,000	2266
No. 4	16.16	8.06x5 x12.06	40.3	66,500	1650
No. 5	15.81	8 x5.06x12.06	40.48	72,500	1791

ABSORPTION TEST

Mark	Original Weight Pounds	Final Weight Pounds	Absorption Percent
No. 1	16.18	17.31	6.9
No. 2	15.9	16.81	5.7
No. 3	16.18	17.5	8.7
No. 4	15.63	17.0	8.7
No. 5	15.81	17.12	8.3

All tests in accordance with specifications submitted, same being part of the amended building Code of the City of Chicago as relating to Hollow Clay Tile for strength and absorption.

PITTSBURGH TESTING LABORATORY,
W. D. BEISELL.

H. H. HOLMES,
Manager Chicago District.

Natco Two Cell Glazed Bakup Tile

THE UNIVERSITY OF WISCONSIN
COLLEGE OF ENGINEERING
DEPARTMENT OF MECHANICS
LABORATORY FOR TESTING MATERIALS

REPORT OF TEST OF 8″x5″x12″ TWO CELL GLAZED BAKUP TILE MANUFACTURED AT BRAZIL, INDIANA PLANT

Results of Tests on Clay Building Tile.
Made for National Fire Proofing Co.
Samples selected by Manufacturer.
Scoring or facing—Top and one face plain; other faces scored 0.05-inch deep.
Brands or Marks—None, all faces glazed.

WARPAGE:

None in No. 139 and 140.
0.05-inch or 0.417% in No. 141.

(B) COMPRESSION TEST DATA

Loaded on 8x12-inch faces, cells horizontal.			Bedded in Plaster of Paris
Mark or Number	Natco 139	Natco 140	Natco 141
Seal Number	not sealed		
Weight of Block (lb.)	18.20	17.45	18.40
Height (inches)	4.95	4.9	4.95
Dimensions of Loaded Cross Section (in.)	7.8x11.85	7.8x11.85	7.8x11.85
Area of Section (sq. in.)	92.5	92.5	92.5
Maximum Load (lb.)	236,000	249,000	297,000
Ultimate Strength (lb. per sq. in.)	2550	2690	2880
Color	Very Dark Brown; uniform glassy.		

Character of Fracture—Light brown inside with black and white specks. No laminations. Very dense.
Remarks—Complete shear failure in each.
Date of Compression Test—June 23, 1926.

(C) VOIDS TEST DATA

Mark or Number	Natco 139	Natco 140	Natco 141
Section Area (sq. in.)	4.9x7.75—38.0	4.85x7.75—37.6	4.9x7.75—38.0
Number of Cells	Two rectangular cells in each		
Cell Dimensions (in.)	3.45x2.9—10	3.45x2.9—10	3.45x2.9—10
Cell Area (sq. in.)	20.0	20.0	20.0
PERCENT VOIDS	52.6	53.2	52.6

(D) ABSORPTION TEST DATA (Weight in Pounds)

Mark or Number	Natco 139	Natco 140	Boiling Test Natco 141
Weight after Immersion in Water 1 hour	18.36	17.67	18.55
Weight, Dry Specimen	18.20	17.44	18.40
Gain in Weight	0.16	0.23	0.15
PERCENT ABSORPTION	0.88	1.32	0.82

Madison, Wisconsin, July 2, 1926.

C. A. WIEPKING,
Observer.

UNIVERSITY OF WISCONSIN
COLLEGE OF ENGINEERING
DEPARTMENT OF MECHANICS
LABORATORY FOR TESTING MATERIALS

REPORT OF TEST OF 6″x12″x5″ GLAZED DOUBLE SHELL COATED FACE TILE MANUFACTURED AT BRAZIL, INDIANA PLANT

Results of Tests on Clay Building Tile.
Made for National Fire Proofing Co.
Samples selected by Manufacturer.
Scoring or facing—One face plain, one rib-scored 0.02-inch, ends depressed.
Brands or Marks—"NATCO" impressed in one end of each.

WARPAGE:

0.06-inch in each
or 0.417%.

(B) COMPRESSION TEST DATA

Loaded on 6x12-inch faces; cells vertical.

Mark or Number	Natco 148	Natco 149	Bedded in Plaster of Paris Natco 150
Seal Number	not sealed		
Weight of Block (lb.)	15.93	15.79	16.20
Height (inches)	5.0	5.0	5.1
Dimensions of Loaded Cross Section (in.)	5.9x12.0	5.9x12.0	6.0x12.1
Area of Section (sq. in.)	70.8	70.8	72.6
Maximum Load (lb.)	455,000	540,000	over 600,000
Ultimate Strength	6430	7640	over 8290
Color	Uniform Dark Brown Color.		

Character of Fracture—Dense texture; light brown color inside with black and white specks. No laminations.
Remarks—Complete shear failure in each.
Date of Compression Test—June 23, 1926.

(C) VOIDS TEST DATA

Mark or Number	Natco 148	Natco 149	Natco 150
Section Area (sq. in.)	70.8	70.8	72.6
Number of Cells	Three large and twelve small cells in each		
Cell Dimensions:			
Middle Cell	2.25x3.2 —7.2	2.25x3.2 —7.2	2.25x3.2 —7.2
2 Outer Cells	2.25x2.55—5.74	2.25x2.52—5.67	2.25x2.6 —5.85
12 Small Cells	0.65x1.35—0.88	0.65x1.35—0.88	0.65x1.35—0.88
Cell Area (sq. in.)	32.0	31.8	32.2
PERCENT VOIDS	45.2	45.0	44.4

(D) ABSORPTION TEST DATA (Weight in Pounds)

Mark or Number	Natco 148	Natco 149	Boiling Test Natco 150
Weight after Immersion in Water 1 hour	16.32	16.14	16.89
Weight, Dry Specimen	15.93	15.79	16.20
Gain in Weight	0.39	0.35	0.69
PERCENT ABSORPTION	2.44	2.22	4.25

Madison, Wisconsin, July 2, 1926.

C. A. WIEPKING,
Observer.

THE UNIVERSITY OF WISCONSIN
COLLEGE OF ENGINEERING
DEPARTMENT OF MECHANICS

REPORT OF TEST OF 8"x12"x5" GLAZED DOUBLE SHELL "TEXTILE" MANUFACTURED AT BRAZIL, INDIANA PLANT

Results of Tests on Clay Building Tile.
Made for National Fire Proofing Company.
Samples selected by Manufacturer.
Scoring or facing—Outer face matted; inner scored 0.05-inch deep; ends depressed.
Brands or Marks—"NATCO" impressed in one end of each.

WARPAGE:

None in each tile.

(B) COMPRESSION TEST DATA

Loaded on 8x12-inch faces; cell vertical.

Mark or Number	Natco 154	Natco 155	Natco 156 (Bedded in Plaster of Paris)
Seal Number		not sealed	
Weight of Block (lb.)	19.09	19.55	19.35
Height (inches)	5.1	4.95	5.1
Dimensions of Loaded Cross Section (sq. in.)	8.0x12.1	8.1x12.15	8.05x12.1
Area of Section (sq. in.)	96.8	98.5	97.4
Maximum Load (lb.)	425,000	510,000	480,000
Ultimate Strength (lb. per sq. in.)	4400	5180	4930

Color..... No. 154 Lighter than others; dark brown color, glassy.
Character of Fracture—Dense Texture; no laminations; light brown inside.
Remarks—Shear at one end in No. 154; complete shear in others.
Date of Compression Test—June 23, 1926.

(C) VOIDS TEST DATA

Mark or Number	Natco 154	Natco 155	Natco 156
Section Area (sq. in.)	96.8	98.5	97.4
Number of Cells	Six large and twelve small cells in each		
Cell Dimensions (in.)	Dimensions in all cases same as on Sheet 23		
Cell Area (sq. in.)	47.4	47.4	47.4
PERCENT VOIDS	49.0	48.1	48.7

(D) ABSORPTION TEST DATA (Weight in Pounds)

Mark or Number	Natco 154	Natco 155	Boiling Test Natco 156
Weight after Immersion in Water 1 hour	19.99	20.31	20.21
Weight, Dry Specimen	19.09	19.54	19.35
Gain in Weight	0.90	0.77	0.86
PERCENT ABSORPTION	4.72	3.94	4.45

Madison, Wisconsin, July 2, 1926.

C. A. WIEPKING,
Observer.

THE UNIVERSITY OF WISCONSIN
COLLEGE OF ENGINEERING
DEPARTMENT OF MECHANICS

REPORT OF TEST OF 4"x8"x16" TWO CELL GLAZED BUILDING BLOCKS MANUFACTURED AT BRAZIL, INDIANA PLANT

Results of Tests on Clay Building Tile.
Made for National Fire Proofing Company.
Scoring or facing—All faces plain glazed.
Brands or Marks—"NATCO" impressed in top of each.

WARPAGE:
None in No. 142.
0.08-inch in others,
or 0.31%

(B) COMPRESSION TEST DATA

Loaded on 8x16-inch faces; cells horizontal.

Mark or Number	Natco 142	Natco 143	Natco 144 (Bedded in Plaster of Paris)
Seal Number		not sealed	
Weight of Block (lb.)	19.55	19.77	19.86
Height (inches)	4.0	4.1	4.0
Dimensions of Loaded Cross Section (inches)	8.0x16.05	8.0x15.95	8.0x16.0
Area of Section (sq. in.)	128.5	127.7	128.0
Maximum Load (lb.)	164,000	152,000	172,010
Ultimate Strength (lb. per sq. in.)	1278	1192	1343
Color	All Chocolate Brown—speckled.		

Character of Fracture—Uniform, dense texture. No laminations, Grey-brown color inside.
Remarks—Complete shear failure in each.
Date of Compression Test—June 23, 1926.

(C) VOIDS TEST DATA

Mark or Number	Natco 142	Natco 143	Natco 144
Section Area (sq. in.)	4.0x8.0=32.0	4.1x8.0=32.8	4.0x8.0=32.0
Number of Cells		Two rectangular cells in each	
Cell Dimensions (in.)	2.7x3.1=8.36	2.75x3.1=8.53	2.7x3.1=8.36
Cell Area (sq. in.)	16.7	17.1	16.7
PERCENT VOIDS	52.2	52.1	52.2

(D) ABSORPTION TEST DATA (Weight in Pounds)

Mark or Number	Natco 142	Natco 143	Boiling Test Natco 144
Weight after Immersion in Water 1 hour	20.39	20.56	20.36
Weight, Dry Specimen	19.53	19.77	19.85
Gain in Weight	0.86	0.79	0.50
PERCENT ABSORPTION	4.40	4.00	2.52

Madison, Wisconsin, July 1, 1926.

C. A. WIEPKING,
Observer.

THE UNIVERSITY OF WISCONSIN
COLLEGE OF ENGINEERING
DEPARTMENT OF MECHANICS

REPORT OF TEST OF 8"x8"x16" DOUBLE SHELL GLAZED BUILDING BLOCKS MANUFACTURED AT BRAZIL, INDIANA PLANT

Results of Tests on Clay Building Tile.
Made for National Fire Proofing Company.
Samples selected by Manufacturer.
Scoring or facing—Scored top and bottom; 4 @ .5x.15-in., 1 @ 1.5x11-in.
Brands or Marks—NATCO LOADBEARING imprinted in No. 2 only.
Additional Information—One large cell and 3 small cells (1.8-in. high by 0.5-in. wide) in each side wall.

WARPAGE:

0.05-in. in each.

(B) COMPRESSION TEST DATA

Loaded on 8x16-in. faces, cell horizontal. Bedded in No. 5 Stucco

Mark or Number	1	2	3
Seal Number	not sealed		
Weight of Block (lb.)	35.1	36.1	35.1
Height (inches)	8.0	8.0	8.0
Dimensions of Loaded Cross Section (in.)	7.7x15.8	7.8x15.9	7.7x15.8
Area of Section (sq. in.)	121.7	124.0	121.7
Maximum Load (lb.)	244,000	236,500	277,000
Ultimate Strength (lb. per sq. in.)	2000	1910	2280
Color	Outside, Dark Brown, glazed; Inside and fracture, Chocolate.		

Character of Fracture—In vertical walls, sheared through small cells.
Remarks—No laminations.
Date of Compression Test—September 13, 1928.

(C) VOIDS TESTS DATA

Mark or Number	1	2	3
Section Area (sq. in.)	61.6	62.4	61.6
Number of Cells	One large rectangular; six small rectangular in outer walls		
Cell Dimensions (in.)	4.75x6.25 (29.7)	4.75x6.25 (29.7)	4.75x6.25 (29.7)
Cell Dimensions (in.)	0.5 x1.8 (0.9)	0.5 x1.8 (0.9)	0.5 x1.8 (0.9)
Cell Area (sq. in.)	35.1	35.1	35.1
PERCENT VOIDS	57	56	57

(D) ABSORPTION TEST DATA (Weight in Grams on pcs.)

Mark or Number	1	2	3
Weight after Immersion in Water 1 hour	2423	1915	2211
		Boiling Test	
Weight, Dry Specimen	2365	1856	2123
Gain in Weight	58	59	88
PERCENT ABSORPTION	2.5	3.2	4.1

Madison, Wisconsin, September 15, 1928.

PAUL T. NORTH,
Observer.

MATERIALS TESTING LABORATORY

DEPARTMENT OF ENGINEERING MECHANICS

YALE UNIVERSITY

REPORT ON TEST OF NATCO INTERLOCKERS

Compression Test of Building Block

Made by Geo. W. Colton — Date March 30, 1929.

GENERAL DATA

Test of NATCO Interlockers.

Manufacturer—The National Fire Proofing Co.

Test made for The National Fire Proofing Co.

Application for test made 2-27-29.

Test made in Riehle University Test Machine, 100,000 lbs. max. cap.

Method of seating—Plaster of Paris and Lumnite Cement Mortar.

Specimen number	1	2	3	4	5
Nominal dimensions, 12x8x6 in.					
Actual dimensions, 11⅞x8x6⅝ ins.					
Thickness of web, 0.65 ins.					
Thickness of shell, 0.75 ins.					
Number of cells, 4					
Position in which tested, 8x12 cells horizontal					
Gross area sustaining load, 96 sq. in.					
Net area sustaining load, .. sq. ins.					
Load on machine (beam reading), (lbs.)	91,450	88,310	110,000+	98,000	106,000
Additions, if any (lbs.)	none				
Total load at failure (lbs.)	91,450	88,310	110,000+	98,000	106,000
Ultimate strength (gross area) lbs. sq. in.	952	899	1,150+	1,020	1,100

Specimen 1, 2, 5 were bedded in Plaster of Paris.

Specimen 3, 4 were bedded in Lumnite Cement.

Specimen No. 3 was loaded to the limit of the machine and gave no evidence of failure.

Signed, GEO. W. COLTON

Date 4-1-29.

THE JAMES H. HERRON CO.
CONSULTING ENGINEERS
CLEVELAND, OHIO.

REPORT OF LOAD TESTS OF FLOOR SLABS END CONSTRUCTION SKEWS AND INTERS, SIDE CONSTRUCTION KEYS, AT CARNEGIE MEDICAL BUILDING, CARNEGIE AVE. & E. 105th STREET FOR THE AUSTIN COMPANY, CLEVELAND, OHIO

Purpose of Test:

The purpose of this test was to determine the deflection of this type of tile floor.

Method of Making Test:

From the center of the selected slab 8 ft. 4 inches x seven ft. a plumb bob was suspended by means of a fine wire to within one foot of the basement floor. Directly under the plumb bob a micrometer head was rigidly attached to a fixture which in turn was cemented to the floor. The micrometer head was screwed up until it came in contact with the plumb bob point and the micrometer reading was taken as the zero point.

An inspection was made of the under side of this slab for cracks or any other defects which might contribute to its weakness.

The area of the slab to be tested was carefully measured to determine the total test load. A load equivalent to twice the live load plus the dead load or 320 pounds per square foot was applied by using sacks of Portland Cement evenly distributed over the area to be tested.

Micrometer readings were taken at 44 pounds per square foot, 218 pounds per square foot and 320 pounds per square foot. The 320 pound load was allowed to remain on the slab for a period of 24 hours after which a final reading was taken.

Results of Test:

The following figures show the deflection at the point taken at different loads:—

Load per square foot	Deflection in inches
44 lbs.	.012
218 lbs.	.059
320 lbs.	.088
320 lbs. after 24 hours	.125

It will be noted that the maximum deflection did not exceed ⅛ inch, this would indicate that the maximum stress was within the elastic limit of the material used in the construction of this slab. After the load had been applied no cracks were found that would prove detrimental or hazardous under the load for which the floor was designed.

Conclusion:

From an examination of the above test results it is evident that there is no reason why the floor of this building will not withstand the load for which it is designed.

Respectfully submitted,

THE JAMES H. HERRON COMPANY
Engineer of Test
Robert J. Krez

General Data Section

TABLES FOR DETERMINING HEIGHT AND LENGTH OF WALL

These tables are not only for the use of the architect in planning the job, but should be referred to frequently by the masonry contractor during the actual construction of the walls. They are useful for planning and building the openings, as well as determining the general dimensions of the walls.

While these tables have been prepared as a ready reference and will be found very helpful, it should be remembered that it is always possible to vary the thickness of the mortar joints and thereby change the dimensions slightly.

HEIGHT TABLE—8″ x 12″ x 5″ Tile—⅜″ Joints

The table below is used to determine the height of walls which will best lay up without cutting tile, using ⅜″ bed joint. For instance, should you desire to build a wall 17′ high, you will note by referring to the table that it will require 38 courses.

Course No.	Height	Course No.	Height	Course No.	Height
1	— 5⅜″	21	9′— 4¼″	41	18′— 4⅝″
2	—10¾″	22	9′—10½″	42	18′— 9¾″
3	1′— 4⅛″	23	10′— 3⅝″	43	19′— 3⅛″
4	1′— 9½″	24	10′— 9″	44	19′— 8½″
5	2′— 2⅞″	25	11′— 2¾″	45	20′— 1⅞″
6	2′— 8¼″	26	11′— 7¾″	46	20′— 7¼″
7	3′— 1⅝″	27	12′— 1⅛″	47	21′— 0⅝″
8	3′— 7″	28	12′— 6½″	48	21′— 6″
9	4′— 0¾″	29	12′—11⅞″	49	21′—11⅜″
10	4′— 6¼″	30	13′— 5¼″	50	22′— 4¾″
11	4′—11⅝″	31	13′—10⅝″	51	22′—10¼″
12	5′— 4½″	32	14′— 4″	52	23′— 3½″
13	5′— 9⅞″	33	14′— 9¾″	53	23′— 8⅞″
14	6′— 3¼″	34	15′— 2¾″	54	24′— 2¼″
15	6′— 8⅝″	35	15′— 8⅛″	55	24′— 7⅝″
16	7′— 2″	36	16′— 1½″	56	25′— 1″
17	7′— 7¾″	37	16′— 6⅞″	57	25′— 6¾″
18	8′— 0¾″	38	17′— 0¼″	58	26′—11¾″
19	8′— 6⅛″	39	17′— 5⅝″	59	26′— 5½″
20	8′—11½″	40	17′—11″	60	26′—10½″

LENGTH TABLE—8″ x 12″ x 5″ Tile—⅜″ Joints

The table below shows the length of walls and pilasters that can be best laid up without cutting tile, using ⅜″ vertical mortar joints. For instance, should you desire a wall 35′ long, by referring to the table you will find that it will require 34 tile. By humoring or varying the mortar joints, this dimension can be varied slightly.

To find width of openings, add two mortar joints or a total of ¾″ to each dimension in table.

No.—Tile	Length	No.—Tile	Length	No.—Tile	Length
1	1′— 0″	11	11′— 3⅝″	21	21′— 7½″
1½	1′— 6½″	11½	11′— 9⅛″	21½	22′— 1⅝″
2	2′— 0¾″	12	12′— 4½″	22	22′— 7⅛″
2½	2′— 6½″	12½	12′—10½″	22½	23′— 2″
3	3′— 0¾″	13	13′— 4⅛″	23	23′— 8¼″
3½	3′— 6⅞″	13½	13′—10⅝″	23½	24′— 2⅝″
4	4′— 1⅛″	14	14′— 4⅞″	24	24′— 8⅝″
4½	4′— 7¼″	14½	14′—11″	24½	25′— 2¾″
5	5′— 1⅜″	15	15′— 5¼″	25	25′— 9″
5½	5′— 7⅝″	15½	15′—11⅛″	25½	26′— 3⅛″
6	6′— 1⅞″	16	16′— 5⅝″	26	26′— 9⅛″
6½	6′— 8″	16½	16′—11¾″	26½	27′— 3½″
7	7′— 2¼″	17	17′— 6″	27	27′— 9¾″
7½	7′— 8¾″	17½	18′— 0⅛″	27½	28′— 3⅞″
8	8′— 2⅝″	18	18′— 6⅜″	28	28′—10¼″
8½	8′— 8¾″	18½	19′— 0½″	28½	29′— 4½″
9	9′— 3″	19	19′— 6¾″	29	29′—10½″
9½	9′— 9⅛″	19½	20′— 0⅞″	29½	30′— 4⅝″
10	10′— 3⅝″	20	20′— 7⅛″	30	30′—10⅞″
10½	10′— 9½″	20½	21′— 1¼″	30½	31′— 5″

Note: The dimensions given in above tables are for the convenience of estimating only, and we, therefore, recommend that all joints be made uniform, ⅜″, ½″ or whatever size may be agreed upon, and disregard bond to obtain best results.

HEIGHT TABLE

$3\frac{3}{4}''$ x 5″ x 12″
8″ x 5″ x 12″ } Tile—¼″ Joints

The table below is used to determine the height of walls which will best lay up without cutting tile, using ¼″ bed joint. For instance, should you desire to build a wall 17′ high, you will note by referring to the table that it will require 39 courses.

Course No.	Height	Course No.	Height	Course No.	Height
1	— 8½″	21	9′— 2½″	41	17′—11½″
2	—10½	22	9′— 7½″	42	18′—4½″
3	1′— 3½″	23	10′— 0½″	43	18′— 9½″
4	1′— 9″	24	10′— 6″	44	19′— 3″
5	2′— 2½″	25	10′—11½″	45	19′— 8½″
6	2′— 7½″	26	11′— 4½″	46	20′— 1½″
7	3′— 0¾″	27	11′— 9¾″	47	20′— 6¾″
8	3′— 6″	28	12′— 3″	48	21′— 0″
9	3′—11¼″	29	12′— 8¼″	49	21′— 5¼″
10	4′— 4½″	30	13′— 1½″	50	21′—10½″
11	4′— 9¾″	31	13′— 6¾″	51	22′— 3¾″
12	5′— 3″	32	14′— 0″	52	22′— 9″
13	5′— 8¼″	33	14′— 5¼″	53	23′— 2¼″
14	6′— 1½″	34	14′—10½″	54	23′— 7½″
15	6′— 6¾″	35	15′— 3¾″	55	24′— 0¾″
16	7′— 0″	36	15′— 9″	56	24′— 6″
17	7′— 5¼″	37	16′— 2¼″	57	24′—11¼″
18	7′—10½″	38	16′— 7½″	58	25′— 4½″
19	8′— 3¾″	39	17′— 0¾″	59	27′— 9¾″
20	8′— 9″	40	17′— 6″	60	28′— 3″

LENGTH TABLE

$3\frac{3}{4}''$ x 5″ x 12″
8″ x 5″ x 12″ } Tile—¼″ Joints

The table below shows the length of walls and pilasters that can be best laid up without cutting tile, using ¼″ vertical mortar joints. For instance, should you desire a wall 33′ 8″ long, by referring to the table you will find that will require 33 tile. In fairly long walls, by humoring or varying the mortar joints, the necessity for short lengths of tile can be avoided.

To find width of openings, add two mortar joints or a total of ½″ to each dimension in table.

No.—Tile	Length	No.—Tile	Length	No.—Tile	Length
1	1′— 0″	11	11′— 2½″	21	21′— 5″
1½	1′— 6½″	11½	11′— 8½″	21½	21′—11½″
2	2′— 0¼″	12	12′— 2¾″	22	22′— 6¼″
2½	2′— 6¾″	12½	12′— 8⅛″	22½	22′—11⅝″
3	3′— 0⅛″	13	13′— 3″	23	23′— 5½″
3½	3′— 6⅝″	13½	13′— 9⅛″	23½	23′—11⅝″
4	4′— 0¾″	14	14′— 3½″	24	24′— 5¾″
4½	4′— 6⅞″	14½	14′— 9⅝″	24½	24′—11⅞″
5	5′— 1″	15	15′— 3¾″	25	25′— 6″
5½	5′— 7⅛″	15½	15′— 9⅞″	25½	26′— 0⅛″
6	6′— 1¼″	16	16′— 3⅞″	26	26′— 6¼″
6½	6′— 7⅜″	16½	16′— 9⅞″	26½	27′— 0⅜″
7	7′— 1½″	17	17′— 4″	27	27′— 6½″
7½	7′— 7⅝″	17½	17′—10⅛″	27½	28′— 0⅝″
8	8′— 1¾″	18	18′— 4¼″	28	28′— 6¾″
8½	8′— 7⅞″	18½	18′—10⅜″	28½	29′— 0⅞″
9	9′— 2″	19	19′— 4½″	29	29′— 7″
9½	9′— 8⅛″	19½	19′—10⅝″	29½	30′— 1⅛″
10	10′— 2¼″	20	20′— 4¾″	30	30′— 7¼″
10½	10′— 8⅜″	20½	20′—10⅞″	30½	31′— 1⅜″

Note: The dimensions given in the above tables are for the convenience of estimating only, and we, therefore, recommend that all joints be made uniform, ¼″, ⅜″ or whatever size may be agreed upon, and disregard bond to obtain the best results.

ARGUMENTS AGAINST SUB-STANDARD TILE

1. All tests on hollow building tile have been made at the Bureau of Standards, under the jurisdiction of the U. S. Department of Commerce, an unbiased Government body, the results of whose research is used for the benefit of the public.

2. Every phase of the use of our material has been covered in a very complete way through numerous programs extending over a period of six and one-half years.

3. These findings are now the basis of minimum requirements as established by the American Society for Testing Materials, the Division of Simplified Practice of the Department of Commerce and the Federal Specifications Board.

4. These minimum weights are now being written into all city and state building codes wherever they are being written or revised and the Building Officials Conference has endorsed these standards as correct. In communities wherein there are no requirements for tile, the architects, engineers, and contractors should protect their own interest by specifying standard tile.

5. Had it been possible, the American Society for Testing Materials, who work in conjunction with the Bureau of Standards, would have set up lower standards as a public economy.

6. The Hoover Code and codes established by cities and states permit a working stress of from 80 to 100 pounds per square inch for hollow tile construction. The minimum standards on hollow tile as set up will insure a wall which will carry at least three times the allowable working stress or load, thus affording the required engineering factor of safety of three to one.

7. Load-bearing tile should be used in all interior walls which are designed to carry a load and in all exterior walls, both load-bearing and non-load-bearing, whether exposed or faced with other materials.

8. Partition tile made from surface clay with high porosity and underburned tile of shale or fire clay may be perfectly satisfactory in every respect for non-bearing partitions, and are sold for such purpose, but when used for exterior walls, as they frequently are, they have not sufficient strength to resist the effect of the expansion and contraction of hard stucco; the consequence being that the stucco pulls away from the tile and comes off, taking a part of the tile surface with it.

Summary.—Any architect or contractor who specifies sub-standard tile is disregarding the findings of the highest authorities in the country.

*FIRE RESISTANCE PERIODS OF WALLS OF LOAD BEARING HOLLOW TILE

Thickness of wall inches		Number of Units in wall thickness	Number of cells in wall thickness	Fire Resistance period, hours	
				Unplastered	Plastered both sides
8		1	2	1½	2½
8		1	3	2	3
8	(Brickfaced, plaster on fire side only)	2	1	....	4½
8		2	2 or 3	....	5
12	(Furred one side)	1	3	3	4
12		2	3	4	5
12		2	4	....	7
12	(Brickfaced, plaster on fire side only)	2	2	5	6
16		2 or 3	4	8	10
18		2 or 3	6	10	12

This would make 8-inch walls adequate in residence, office and institutional occupancies where no considerable accumulation of combustible material is present. For the more severe exposures from mercantile and manufacturing

occupancies with moderate amounts of combustible materials, the 12-inch wall will apparently be adequate. Walls heavier than 12-inches may be required for the heavy manufacturing warehouses or storage occupancies. These conclusions are based on tests with unplastered walls. As indicated in the table, plaster adds from 1¾ to 3 hours to the ultimate fire resistance of the wall; however, this is true only when either gypsum or cement plaster is used, as lime plaster adds very little to the fire resistance of the wall.

*Published by Permission of the Director of the National Bureau of Standards of the U. S. Department of Commerce.

INSULATING VALUE OF VARIOUS WALLS

(Compiled by The Structural Clay Tile Association)

This table shows B.T.U's (British thermal units) transmitted per square foot per hour per degree difference in temperature between inside and outside for the given materials. The larger the index figure or coefficient, the greater the heat loss and the less efficient are the walls.

8″ Walls

		B.T.U.
(2)	4″ Face Brick plus 4″ Structural Clay Tile, furred and plastered	.24
(4)	Structural Clay Tile, furred and plastered	.25
(3)	Structural Clay Tile, 2 units, stuccoed and plastered	.26
(1)	Brick, furred and plastered	.27
(3)	Structural Clay Tile, stuccoed and plastered	.29
(1)	4″ Face brick plus 4″ hollow tile, plastered	.30
(2)	Structural Clay Tile, plastered	.36
(1)	Brick, plastered	.38
(2)	Structural Clay Tile	.40
(1)	Brick	.42
(1)	Concrete	.60

12″ Walls

(4)	Structural Clay Tile, furred and plastered	.17
(2)	4″ Face Brick plus 8″ hollow tile, furred and plastered	.20
(4)	Structural Clay Tile, stuccoed and plastered	.21
(2)	4″ Face Brick plus 8″ hollow tile, plastered	.23
(1)	Brick, furred and plastered	.23
(2)	Structural Clay Tile, plastered	.23
(2)	Structural Clay Tile	.26
(1)	Brick plastered	.29
(1)	Brick	.32
(1)	Concrete	.48

16″ Walls

(2)	4″ Face Brick plus 12″ Structural Clay Tile, furred and plastered	.17
(2)	4″ Face Brick plus 12″ Structural Clay Tile, plastered	.18

The numerals in the first column on the left indicate the source of information as given below:

(1) Heating and Piping Contractors National Association.
(2) American Society of Heating and Ventilating Engineers.
(3) U. S. Bureau of Standards.
(4) Estimated from available data.

APPROXIMATE AMOUNT OF MORTAR REQUIRED IN VARIOUS TYPES OF WALL CONSTRUCTION IN CU. FT. PER 100 SQ. FT.

2″ Wall Furring	1.30
3″ Partitions laid cells horizontal	1.60
4″ Partitions laid cells horizontal	2.00
6″ Partitions laid cells horizontal	2.60
6x12x8 Natco XX	3.41
6x12x12 Natco XXX, 2″ moisture stop	3.28
8x12x12 Natco XXX, 2″ moisture stop	4.60
8x12x12 Natco XX laid cells horizontal	3.25
8x12x12 Natco XX laid cells vert.—longitudinal webs only bedded	3.25
8x12x8 Natco XXX laid cells vert	5.80
8x8x16 Natco Building Blocks	4.63
8″ Wall—3¾x12x10½ Natco XXX and brick bonded	12.70
8x5x12 Bakup	7.25
8x12x5 Natco Double Shell	4.26
8″ Interlocker	7.80
8″ Brick, Solid, Standard size 2¼x3¾x8	18.50
8″ Brick "ideal" hollow wall	8.08
8″ "Fisklock"	18.50
8″ Denison H. Tile	4.00
10″ Natco XX, 4″ moisture stop	5.25
10x8x16 Natco Building Block	5.70
10″ Header-Backer (6″ tile and brick)	15.50
12″ Natco XXX, 6″ moisture stop	5.90
12″ Header-Backer (8″ Tile and brick)	16.50
12″ Bakup (8x5x12 and 4x5x12)	10.20
12″ Bakup 8x5x12 and brick bonded 7th and 8th courses	18.10
12″ Interlocker (8″ tile and brick)	19.10
12″ Brick, solid	27.80
14″ Header-Backer (10″ tile and brick)	17.50
16″ Header-Backer (12″ tile and brick)	18.50
16″ Header-Backer (8x12 tile laid 12″ way and brick)	19.12

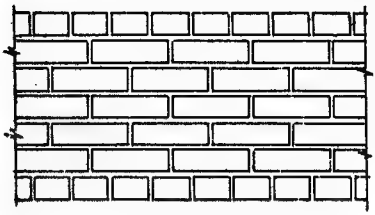
REINFORCED STRUCTURAL CLAY TILE LINTELS

SAFE SUPERIMPOSED LOAD—POUNDS PER LINEAL FOOT—UNIFORMLY DISTRIBUTED

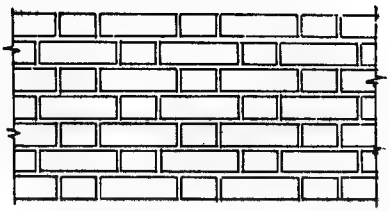
Size of Tile	Depth of Steel	Reinforcing	SPAN OF OPENING						
			4′-0″	5′-0″	6′-0″	7′-0″	8′-0″	9′-0″	10′-0″
8x12x12	10″	2¾″ Ø	1150	900	750	650	550	500	400
8x12x12	10″	2½″ □	1150	900	750	650	550	450	350
8x12x12	10″	2½″ Ø	1150	900	750	600	450	350	250
8x12x12	10″	2¾″ Ø	850	650	450	300	200	100	.....
8x 8x 8	8″	2½″ Ø	650	500	400	300	200	.....	.....
8x 8x 8	8″	2¾″ Ø	500	350	250	150	.....	.....	.....
8x 5x12	3″	2⅝″ Ø	200	100	50	.....	.....	.....	.....

NOTES—All cells in the hollow tile to be filled with concrete equal to 1:2:4 mix.
Standard load-bearing tile of a quality at least equal to the Medium Class to be used.
Lintels to have 8″ bearing.
Use deformed bars for reinforcing steel.
Allowable unit stresses—f_s=18000 #/□″ f_c=650 #/□″
u= 100 #/□″ v= 40 #/□″

STANDARD BRICK BONDS



AMERICAN



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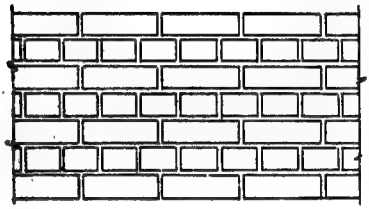

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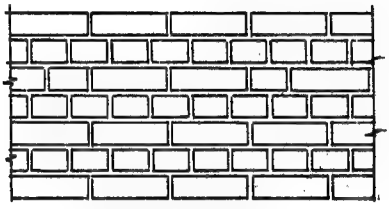
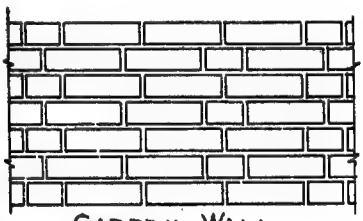
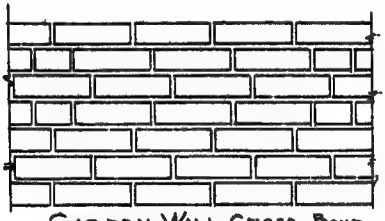


ENGLISH CROSS BOND



GARDEN WALL



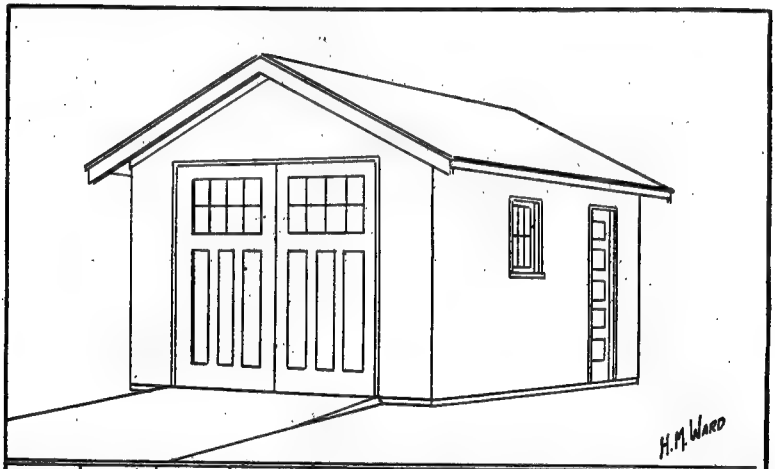
GARDEN WALL CROSS BOND.

Above are standard brick bonds of the United States Bureau of Architecture, Washington, D. C.

HOW MANY TILE

How much easier it is to sell material for garages or other buildings, when one is able to give prospects information right off the bat as to material necessary and the cost.

Structural Clay tile is excellent for garage construction. The chart on this page shows the number of tile necessary for the construction of sixteen different sized garages. These sizes are those most commonly used. Structural Clay tile garages furnish economical protection against the weather, fire and theft. At the same time they are attractive and add permanently to the value of property. Hand this chart to some of your contractors and ask them to furnish estimates for complete structures—and then put your salesmen on the trail of buyers of new machines, and the many automobile owners who do not have a satisfactory garage or none at all.



WIDTH	LENGTH	WALL TILE	JAMB TILE	CORNER TILE	WIDTH	LENGTH	WALL TILE	JAMB TILE	CORNER TILE
10 FT	16 FT	630	104	72	18 FT	18 FT	930	104	72
10	18	680	104	72	18	20	1000	104	72
12	16	680	104	72	20	18	1000	104	72
12	18	750	104	72	20	20	1072	104	72
12	20	820	104	72	20	22	1150	104	72
14	20	900	104	72	22	18	1072	104	72
16	18	900	104	72	22	20	1150	104	72
16	20	960	104	72	22	22	1220	104	72

SIZE OF TILE 8"-5"-12" JAMB TILE TO BE ½ FULL AND ½ HALF JAMB TILE.

Reproduced through the courtesy of "The Building Material Merchant."

TRANSMISSION OF SOUND AND INSULATING VALUES OF PARTITIONS OF VARIED CONSTRUCTION

Recognizing that the ever-increasing concentration of human life in the centers of population with the consequent development of fire resistive construction has generated a problem of economics and social importance, the Bureau of Standards has carried out a number of experiments and tests in an effort to establish some authentic data on sound transmission.

Transmission measurements on panels were made over frequency bands or pitch ranges distributed over the audio frequency range. A frequency of 256 cycles corresponds to "middle C," an average between male and female voice. The soprano "high C" corresponds to a frequency of about 1024 cycles and the higher notes on a piano to about 3000 cycles. It is well recognized that as the energy of a sound wave increases, the response of the ear fails to keep pace with it. We therefore have two kinds of intensity; that of the physical scale such as the telephone measures and that of the ear scale. These scales are connected by the following empirical relationship: the intensity of the sensation of loudness on the ear scale is proportional to the logarithm of the intensity on the physical scale.

A sound barely perceptible to the sense of hearing is naturally regarded by the ear as of very low intensity, nearly zero; but because still feebler sound waves exist the physicist calls the sound at the limit of audibility unity, while on the ear scale its value would be zero, which is the common logarithm of unit. Sounds having the intensity of ordinary speech are rated as having an intensity of one million to one hundred million units on the physical scale while on the ear scale this loudness would be rated as 6 to 8 as these are the common logarithms of the above numbers.

The following table is a concise and condensed arrangement showing the sound resistance properties of different types of materials taken from the Scientific Papers of the Bureau of Standards, No. 526 under date of April 28, 1926, and a separate report issued July 8, 1927.

The highest attainment towards perfect insulation would be indicated by the logarithm 7 or 8, while the lowest value would be indicated by the logarithm 1. The values as established by the foregoing table indicate the superiority of structural clay tile which is particularly adaptable owing to its cellular construction and its high resistance power.

A wall acts as a diaphragm, more or less elastic, and the stiffer and heavier the wall, the fainter will be the registration of sound when same is transmitted from the other side. In construction purposes it must be borne in mind that high qualities of gypsum plaster with hard finishes will give better values for sound insulation when applied over structural clay tile walls than the cheaper absorbent plaster coverings.

To obtain some idea as to the effect of weight or density of walls to break up transmission of sound, the results have been plotted in the form of a curve, the logarithm of the weight per square foot of wall surface being used as abscissas and the average logarithm of the reduction factor as ordinates. As long as the wall is continuous masonry with the plaster applied directly to the surface, the points fall on a straight line within the limit of experimental error and variations which are to be expected in wall structures which are built as near alike as possible. If this straight line can be continued it is evident that to produce a wall which is entirely satisfactory from an acoustical standpoint, the minimum weight per square foot of wall surface must be at least 200 pounds.

"A four-inch clay tile wall with the plaster furred and weighing about 34 pounds per square foot of wall surface is as good acoustically as a wall weighing 218 pounds per square foot of wall surface. **This type of wall should be of considerable importance to builders, as it gives a wall which is easily constructed, is not excessive in weight, and gives a satisfactory degree of sound insulation.**"

It can be logically concluded from the above that the construction of cel-

lular type structural clay tile walls comes nearer being an ideal construction than any other type of wall. It is at once fire resistive, a non-conductor of sound, light weight for constructive purposes, and is an easily available material, low in cost and economical in placement. Its utility is therefore self-evident.

TRANSMISSION OF SOUND THROUGH BUILDING MATERIALS

	Description of Panel	Logarithm of Reduction Factor at Frequency Bands			
		250-251 cy./sec.	1000-1065 cy./sec.	2000-2385 cy./sec.	3000-3365 cy./sec.
(55)	Wood studs, ½" celotex on one side of studs only	2.31	2.49	2.96	2.93
(52)	Wood studs, ½" asbestos "hard" millboard on one side of studs only, joints filled	3.15	2.54	2.69	2.56
(51)	Wood studs, Gypsolite on both sides of studs, joints filled	3.58	4.58	5.21	4.70
(50)	Wood studs, sheetrock on both sides of studs, joints filled	4.35	4.64	4.87	3.97
(59)	Two-inch solid back-plastered partition, metal studs, metal lath	3.41	3.29	4.42	4.34
(29)	Gypsum tile, brown coat of lime plaster, smooth white finish	3.58	3.97	4.22	4.23
(30a)	Gypsum tile, brown coat of gypsum plaster, smooth white finish, plastered one side only	3.35	3.74	4.09	4.42
(30b)	Gypsum tile, brown coat of gypsum plaster, smooth white finish, plastered both sides	4.31	3.93	4.21	4.35
(25)	Brick panel, brown coat of lime plaster, smooth white finish	4.31	4.67	5.45	5.64
(26)	Brick panel, brown coat of gypsum plaster, smooth white finish	4.64	4.68	5.84	6.13
(62)	Structural clay tile of 8" load-bearing tile (medium burned) brown coat gypsum plaster both sides, smooth white finish	4.43	4.89	5.80	5.32
(67)	Structural clay tile panel of 4" partition tile (medium burned) with individual tile laid alternately, cells vertical and horizontal, brown coat gypsum plaster both sides, smooth white finish	4.20	4.23	5.06	4.57
(68)	Structural clay tile panel of 3" partition tile (medium burned) brown coat gypsum plaster on both sides, smooth white finish	4.07	4.33	5.10	5.12
(71)	Structural clay tile cubes with individual tile laid alternately with cells vertical and horizontal, brown coat gypsum plaster on both sides, smooth white finish	4.86	4.84	5.54	5.65
(76)	Flat arch floor of 8" structural clay floor tile, 2" cinder fill, concrete finish, plastered under side	4.67	4.74	5.05	4.91
(77)	Combination floor of 6" structural clay tile, 2" concrete on top, plastered under side	4.90	5.09	6.23	5.30

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